

DOCUMENT RESUME

ED 345 714

IR 015 548

AUTHOR Leino, Jarkko
TITLE Dynamic Knowledge in School. An Action Research on Instructional Development with the Aid of Microcomputers. Research Bulletin 79.
INSTITUTION Helsinki Univ. (Finland). Dept. of Education.
REPORT NO ISBN-951-45-6013-2; ISSN-0359-5749
PUB DATE 91
NOTE 125p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS *Adoption (Ideas); *Change Strategies; Curriculum Development; Educational Research; Elementary Secondary Education; Foreign Countries; Information Technology; Inservice Teacher Education; *Instructional Development; *Instructional Innovation; *Microcomputers; Program Evaluation; School Restructuring; Student Participation; *Teacher Role
IDENTIFIERS *Finland

ABSTRACT

A 5-year project conducted in three comprehensive schools in a small community near Helsinki, Finland, was designed to integrate new information technology into the curriculum and to assist teachers in changing traditional instructional practices. General goals of the project were: (1) to make the knowledge and learning process more active; (2) to help learning become a cooperative process in which teachers are facilitators rather than information presenters; (3) to help learners experience and participate in the responsibility for their own learning; (4) to effectively use new technology, represented by the microcomputer; and (5) to integrate school knowledge with students' other knowledge of society. The teachers' interest in the project was awakened with the aid of microcomputers. All of the teachers and principals participated voluntarily in the project, which, after the first stage, turned out to be an expanding undertaking for instructional and administrative development. The basis for development was teachers' small-group activities; the groups of 7 to 12 teachers decided on the objectives of each experimental year and planned and carried out the inservice education needed for attaining the objectives. An action-researcher interpreted relevant research results and gave practitioners help and advice in making use of the new technologies. This final report covers the rationale for the project; the theoretical background for curriculum, staff, and organizational development; the research method used to evaluate the project; problems and data gathering; the results of each of the experimental years; the viewpoints of the superintendent, the principals, and the teacher's groups; and a discussion of the changes in the schools. It is noted that the project was successful, and that, although the official project has been completed, the pioneering effort will continue. (74 references) (DB)

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RESEARCH BULLETIN 79

Jarkko Leino

DYNAMIC KNOWLEDGE IN SCHOOL

An Action Research on Instructional Development
with the Aid of Microcomputers

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Helsinki 1991

ISBN 951-45-6013-2
ISSN 0359-5749
Helsinki 1992
Yliopistopaino

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by Jarkko Leino

SUMMARY

Normative—re-educative strategy change only occurs when teachers and administrators are encouraged to change their normative orientation in beliefs, values, knowledge, attitudes, skills, and relationships. In order for this to happen it is necessary to activate forces within the school system if one wants to alter the system. The report describes an attempt at such activation in a community near Helsinki.

The main goal of the project, which lasted five years, was to make school knowledge dynamic, i.e. knowledge was to be acquired for some purpose and its use considered meaningful by the students (as well as by the teachers). Scientific knowledge, however, should be regarded as dynamic, too, in order to be useful in the conditions of an individual community, within the schools, and by the staff. In the field of school development there is very little knowledge, if any, based on empirical laws but, instead, a lot of research results which can give a good basis for development if carefully reflected upon in the prevailing conditions. An action-researcher can best help practitioners by interpreting research results and giving suggestions for new applications.

The teachers' interest in the project was awakened with the aid of microcomputers. All the teachers and principals participated voluntarily in the project which, after the first stage, turned out to be an expanding undertaking for instructional and administrative development. The basis for development was teachers' small-group activities: the groups of 7 to 12 teachers decided on the objectives of each experimental year, planned and carried out the in-service education needed for attaining the objectives. Each year a report was published about the state of the project.

During the project the idea of continual school development, i.e. change, was adopted. The teachers' rooms became places where new projects were discussed and cooperatively planned. Simultaneously, decision-making power was delegated to the level of practitioners. The permanent supervisory teams (of teachers) made their suggestions of what to do in the next stage, how to use the financial resources available for instructional materials, what additional resources were needed, etc. Decision-making became professional instead of bureaucratic. The superintendent had an active role in giving the schools new ideas.

The present final report describes as authentically as possible the development process. The five active years in the three schools contain more information than can ever be fully recorded.

Key words: dynamic knowledge, school development, microcomputers in education

ISBN 951-45-6013-2
ISSN 0359-5749

Available from: Department of Education
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Bulevardi 18
SF-00120 Helsinki
Finland

PREFACE

"Successful innovations and reforms are usually clear after they work, not in advance" (Fullan 1991, xi). The present report describes a school-development project which has proved to be successful. It all started with a call six years ago. Superintendent Antti Rönkä called and asked me if I knew a researcher who could offer them some help and advice in a situation, in which new information technology was to be introduced in the local school system. The person in question should also be involved in research, since the superintendent considered it very important to get information on how new technology would, in fact, change the everyday-life of the schools. This is how the project started and has now continued for five years. The researcher I recommended became a kind of "resident visitor", to use David E. Hunt's term, to the schools in the area.

If a school-development project is to be successful, the individuals and groups within the system must see the meaning in what should be changed as well as have an idea as to how to do it. Yet, it is very difficult to resolve the problem of meaning when there is a large number of people with different interests involved. "And often we find meaning only by trying something" (Fullan 1991, xi). In an ideal case these try-outs can be justified on the basis of research, they can be systematic, controlled, and the process can be evaluated continuously. In these respects action research plays an important role. An experienced researcher, capable of co-operation with the different interest group within a school system, can bring into focus all the different aspects necessary for success.

The follow-up results of the project have been annually published in Finnish in the Department of Education Research Bulletin Series, and since the project has attracted a great deal of interest among teachers as well as researchers at home and abroad, this final report will be published in English. Even though this is the closing of the "official" part of the project, the pioneering work in the schools continues. Co-operation between the Department of Education and Kauniainen schools will also continue.

Anna-Liisa Leino

Acknowledgements

If a project lasts five years and involves every teacher and principal all the time, it can become stressing. This is especially so when the researcher often visits the schools, which is necessary in an action research. Without the positive attitude of the teachers, principals, and superintendent in Kauniainen, the project could not have been carried out. I owe a special debt of gratitude to all the teachers and principals who actively participated in the project, worked with me, wrote papers and reviews, answered questionnaires, and helped me in many other ways to collect the data. Without such wonderful people this kind of project could not have been possible.

Superintendent Antti Rönkä has worked with me all the time. He has actively encouraged the teachers to search for new pilot projects, invited me to take a stance on many difficult school-development problems, and had made important contacts with various authorities and agencies. My thanks are due him.

Warm thanks to Professor Raimo Konttinen for the crucial help during the first stage of the project, to the superintendents of the National School Board with whom I could discuss many questions, and to other members of the group of project leaders.

I express my gratitude to SITRA (the Finnish National Fund for Research and Development), the Finnish Academy, and the National School Board for the financial support I received.

Helsinki, Nov. 15. 1991. Jarkko Leino

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1 Introduction

The report describes a five-year project which focussed on the instructional development of the primary and secondary school. The project was carried out in a small town near Helsinki. All Finnish-language schools of the town participated in the project. The main idea was to increase teachers' professional competence in terms of reflectivity and cooperation. Teachers participated in the project on a voluntary basis. The first goal of the project was to familiarize the teachers with microcomputers and their pedagogical use. All the teachers wanted to participate and when the project continued to have more comprehensive goals, e.g. dynamic knowledge and methods best suited for this purpose, all the teachers still wanted to participate. The study can be classified as an action research.

To attempt to change the instructional tradition in schools is always as hard and difficult as to change people's traditional habits and attitudes. School has its own culture, with activities which have been chosen on the basis of their workability and felt usefulness. Even though the conditions under which the traditions have been formed and established may have totally changed, the habits still continue to live. A new generation of students, who have no knowledge of the basis of the traditions, experience the school culture as their own world which has nothing to do with the real world outside the school. This is a part of the generation gap.

A high level of technology and increasing amounts of scientific information in all sectors of life can be regarded as typical of our society. Modern electronic technology has penetrated into almost all vocational areas and everyday life. Microcomputers, telecommunications, videos, CD-discs and their combinations have changed our world. Enormous amounts of information can be packed into small CD-discs which are readily available to everybody. The main problem is how to choose and

make this information useful to one's actual purpose. The bulk of information is so large that it is impossible for anybody to remember, and to even try is a waste of time. Students know this, and it is one of the main reasons why it is so unmotivating for students to learn the information in textbooks. It was this aspect that made the authors of the project, described further in detail, to seek a change in traditional teaching.

The problems of schools are universal. In all industrial countries, the curricula are large, pre-fixed, and full of the "necessary" basic information of school subjects. Room for individuality is minimal. The problems have also been discussed e.g. by an American colleague (Mamchur 1990) who has also posed some critical questions regarding the reasons for the problems, as follows:

"Like everyone else, secondary teachers get tired and frustrated — even fed up — from time to time. They see their best-laid plans and hardest work wasted on students who seem not to care. ... If teachers tend to blame students — to bemoan their lack of interest, their laziness, their resistance — then perhaps the teachers had better ask themselves a few tough questions. These are the questions imprinted on my mental screen:

- 1) How often do students have choices in the classroom?
 - 2) How often do students feel in control, in charge of themselves?
 - 3) How many decisions that really count are students allowed to make?
 - 4) How are students responsible for their own learning?
 - 5) How do your students know when they have pleased you?
 - 6) How do you know when you have pleased them?
 - 7) How often is there a right answer to the questions you ask of your students?
 - 8) How often do students feel important in your classroom?
 - 9) How often do you and your students share laughter in your classroom?
 - 10) How do the students react when they walk into your classroom? Happy? Calm? Safe? Excited? Assured? Afraid? Bored? Sorry?
- I hear a standard set of responses. "We have no time to allow for choices — the curriculum has to be covered!", "Students aren't able to make decisions regarding curriculum!", "It's on the exam, and

that's that!", "This is secondary school!" The answers deal with power, not with curriculum. Could it be that secondary teachers hide behind the safe excuse, the cop-out excuse, the it's-always-been-this-way excuse, the excuse that blames curriculum requirements when what we really want is power?"

The quotation reveals typical attitudes in traditional school work. My interpretation of teachers' attitudes in our school in Finland is as follows:

- teaching has to cover the curriculum according to the textbooks
- the matriculation exam is the final and the only criterion of learning and the quality of teaching
- fixed subject-based objectives on each grade-level are the measure of an individual student — he (or she) has failed if he has not achieved the standard, no matter how successful his personal development in other respects may have been
- each school subject has its own knowledge structure necessary for every student no matter how uninteresting or irrelevant it may seem
- new technology is accepted in the classroom if it promotes traditional teaching
- the subject teacher has to be an expert in his (or her) subject, but not necessarily in planning curriculum together with other teachers
- it is not the teachers' duty to develop the school, curriculum or in-service education — the teachers' duty is to implement curriculum developed by curriculum experts and politicians, and
- it is the administrators' duty to arrange suitable in-service education for teachers.

These were also the antecedents five years ago when the project started.

Some general goals were set for the project:

- 1) the knowledge and learning process becomes more active than in the traditional teacher-centred process (in which the teacher introduces a

new theoretical topic, according to the textbook, and students apply theory in several exercises),

2) learning becomes a co-operative process in which the teacher's role is to be more of a planner and supporter than an information-presenter,

3) learners will experience that they themselves are responsible for their own learning,

4) new technology, represented by the microcomputer, can be used as a tool and, hence, programs such as word processing, graphics, spreadsheets, data banks should be emphasized, and

5) school knowledge becomes integrated with students' other knowledge of the society and its actual problems.

Active knowledge and the learning process mean that the subject matter is learnt for some purpose which is meaningful to the students (Dewey 1938), not just information from the teacher or textbook to be remembered as such. Traditionally, the teacher has strongly relied on the textbook, with the result that students have experienced it as their duty to adopt and remember the contents of the book. Thus, knowledge has meant for them the information "out there" in the textbook, not something to be processed in their minds or acquired and used for certain purposes. One of the main goals of the project was to change this fragmentary and non-motivating learning and static conception of knowledge.

Another main goal was that the so-called new technology could have an active role in all school subjects, as it has in different sectors of society. In the beginning this aspect was so dominant that the project was entitled "Microcomputers — a tool for instructional development". The computer was seen as a tool for different tasks: it could be used in writing, drawing, printing, or telecommunication, and as an information source.

Of course, the goals above are what we aimed for. They are expressions of efforts and ambitions, not something that can be attained immediately. Still, they are worth mentioning because, as value expressions, they guided planning and decision-making in the project. It was neither possible nor desirable in the project to change in any way the external conditions in the experimental community, such as the school law, the matriculation exam or the general administration; the purpose was to search for a better instructional practice within the limits of the so-called "free-community experimentation" and the financial support the municipal government could offer to the project. The idea of the "free-community experimentation" is to delegate the decision-making power to the level where the greatest expertise is to be found; which means, in the highly centralised school system of Finland, that some decision-making power is given to local school authorities and to the teachers of the municipal schools.

Because all developments in school depend on the teachers' activity, in-service education and an emphasis on the teachers' reflective role were central from the beginning. Teacher-thinking (Shulman 1986), the teacher as a professional (Zeichner 1986), the teacher-as-researcher (Stenhouse 1975, Elliott 1990), the reflective practitioner (Schön 1983), "Inside-out Strategy instead of Outside-in Strategy" (Hunt 1987) offered a basis for the researcher and the development strategy of the project. It is the teachers who develop the school, but in this process they need long-term support from researchers, administrators and municipal authorities (Wideen 1987). This kind of support has been called "teacher coaching" by Joyce and Showers (1984) (in fact, quoting Dewey), and it means that the teachers have a "scientific consultant" to discuss with for a long time. It was also assumed that an individual teacher is seldom a school reformer.

What is also needed is the support from other teachers. It has often been noticed that traditional in-service education, though experienced rewarding by an individual teacher, has hardly had any effect on his (or her) teaching practice. Hence, it was important to have teachers work together, share their experiences, think about and discuss what kind of improvements are needed, what is possible, how new ideas work in practice, what problems might have appeared, what kind of help is needed, etc. We are convinced that teaching practice can essentially develop only if teachers actively participate in the process of articulating, analysing and hypothesising solutions to complex educational problems. The purpose of school development is to bring about worthwhile educational changes in which teachers and students play an important and significant role as participants. Educational values are not universal and fixed, but infinitely contestable and in practice dependent on particular situations.

We found it very difficult to separate the theoretical starting points and the practice. Theories and former studies have certainly influenced decision-making; but which of the theories and how they have influenced is much harder to determine. The same difficulty also bothered us when we wrote the present report. It seemed impossible to give a firm theoretical basis in the beginning, and then to fit the activities and results of the project into this framework. Neither did it seem better to first describe all the activities and the results, and then to reflect on it all to distinguish the essential. What, in fact, is done is a mixture of both extremes.

2. Rationale

Before the theoretical basis of the project will be presented in detail, some general features of the Finnish school system, the experimental community and the course of intentions and activities are worth mentioning.

The official curriculum of a nine-year comprehensive school, such as it is now in Finland, is community-based. There are very few private schools in the whole country. The school administration is centralised. The general goal is to give municipal authorities, as well as teachers, decision-making power in educational issues. However, instructional materials are used nation-wide, controlled by the National School Board, and they have a strong position in classroom practice — with minor exceptions: some larger communities can afford their own complementary materials in certain school subjects, and some individual teachers do not use official textbooks. The teachers plan the curriculum of the community but based on the "Basis of the Curriculum" prepared by the National School Board. In practice, most of the communities just copy the "Basis of the Curriculum". Thus communities and teachers do not use their planning power.

In-service education has been compulsory for more than two decades, and it was established to inform teachers about research results to be applied in practice. Three working days a year are reserved for this purpose. However, these three days are placed on separate Saturdays during the school year; the programme is prepared by the school administration office and teachers regard in-service education as a necessary evil to get their salary. The content of the in-service training is usually quite general, and its direct effects on school practice have been of minor importance according to the studies.

The community of the project is a small bilingual town near Helsinki, and the inhabitants there have a higher educational level than the average in Finland. The municipal tax is the lowest in the country. The population is less than 8,000, half of which is Finnish (the other half being Swedish-speaking). The Finnish school sector has one elementary school, one junior secondary and one senior secondary school. The number of teachers is over 70. Only the Finnish sector participated in the project. The community appreciates education and is willing to offer its youth a good and modern education. (In Finland the state pays most of the annual school expenses, such as teachers' salaries and students' textbooks according to the regulations and ordinances. Finland is a typical example of a bureaucratic country. It is a well-known saying that "in Finland everything is regulated and controlled".)

Though the inhabitant's attitude to education is more positive in the community of the project than on the average, we can assume that the teachers form a sample of all teachers in southern Finland. The original impulse of the project came from the active superintendent of the municipal school council. He called and extended an invitation to co-plan the framework of the project and to help as scientific consultants to run the project.

In the first year of the project, a group of project leaders was established to give general advice and to make decisions. The members of the group were representatives of the teachers and the administration of the community, a representative of the Ministry of Education and the National School Board, the superintendent (chairing the group) and the principals of the schools, and scientific members. In its first year the project belonged to a larger project supported by SITRA (the Finnish National Fund for Research and Development) and led by Professor Raimo Konttinen. He was also a member of the group of project leaders during

the first year. The basic idea of the SITRA project was to find a relevant way to use microcomputers as tools in schools. Thus, tool programs, such as word-processing, graphics, spreadsheets etc., were emphasized from the very beginning.

The time devoted to in-service education in the project increased from the normal 3 to 6 working days. The community paid for the substitutes when the teachers participated in the in-service courses, as well as for the expenses of the teacher educators of the courses. We, as the researcher of the project, planned the programme of the first in-service education and wrote the annual reports of the state of the art assessments of the previous stage as well as the theoretical bases for the next. As the project continued, the role of the group of project leaders diminished and the planning for the following programmes of the in-service education was delegated to the teachers themselves. (This will be explained further on.) Every year the researcher presented to the teachers (and the representatives of the community) the report to be discussed. In these meetings some practical issues of the next stage were also dealt with.

The action-research method was used as the theoretical approach to the study, though during the first years the role of computers was so dominant that the method was called "a developmental action research". It was partly a development research, in which the main impulse came from outside the schools, and it was left up to the teachers to find pedagogical uses for computers in different subjects and on different school levels, and partly an action research, in which the teachers as practitioners together with the researcher were searching for a better practice (see e.g. Cohen and Manion 1981, 48, 174; Carr and Kemmis 1986, 30). The pure action research aspect became dominant in the later years of the project.

It is worth mentioning that all participation in the project was voluntary and that all the teachers wanted to participate, in particular after they realised that participation was a privilege: they could develop themselves as professionals as well as the school, i.e. their own working conditions.

The procedure of the project was as follows:

1st year. The start was quite traditional: computers (both Macintosh and MS-DOS operating systems) were introduced to all teachers during two three-day-sessions. After the introductory in-service course, both types of computers were placed in the teachers' working rooms in the schools, and in the elementary school, which was just remodelled, eight machines were also placed in one classroom. A record was kept of the times the machines were used and the purposes for which they were used.

In order to have the teachers internalize the instructional use of microcomputers, they were asked to plan a small (2 - 6 lessons) project on how to use computers in their own subject or subjects. They were asked to make their plans co-operatively, in groups of 8 to 12 teachers (two teacher-groups in the elementary school and four subject-teacher groups on the basis of their subject area: foreign language, mathematical subjects, genral subjects, and practical subjects).

After this was accomplished, the teachers were also asked to plan the following six-day in-service education required to carry out the plans for the individual projects. Though this was experienced as very difficult, all groups had their plans before the end of the academic year.

2nd year. The teachers' in-service education in small groups was accomplished according to the their own plans. The idea was that the teachers could practise project-work method in their own in-service

education so that they could use it in their classroom teaching. At the end of the second experimental year, the teachers were asked to prepare new project plans for the following year. In each group a teacher was appointed to supervise based on the group's suggestion. (This led to the creation of an infrastructure for the school development.)

Old School Boards, the members of which were politically appointed, were substituted by new School Boards, the members of which were elected by the students' parents. The teachers and students had their own representatives on these Boards and, of course, the principal belonged to the Board of his (or her) school. In the meetings of the new Boards the basic ideas of the project were introduced by the researcher and the superintendent, and then certain themes were further elaborated. This procedure also became permanent for the whole experiment.

3rd year. The in-service projects were accomplished according to the plans. The groups of teachers became 'planning and discussion units' starting to develop their own teaching as well as the school in general. Decision-making power was delegated to the groups: they planned how the money budgeted for their in-service education, as well as the instructional materials and equipments could be used in their subject areas. A supervisory team of 5 to 6 teachers was established in each school to plan the school development.

4th year. The in-service education was accomplished according to the plans. The teachers were encouraged to use project work in all subjects and at all school levels. The results of these projects were also introduced outside the school, as well as at an international congress.

5th year. The teachers quite generally accepted and adopted project

work as the in-service education method, and as a teaching method in the classroom, and planned several integrated projects. They used modern technology (computers, videos, electronic mail, and even multimedia systems) frequently, if it suited the project. They had their voluntary meetings in which they discussed how to further develop their school.

In the beginning of the project and at the end of each academic year, data gathering was carried out. These were open-ended inquiries, structured inquiries, the teachers' own reports, structured interviews, or students' project-reports. Also, minutes of teachers' meetings and the researcher's observations were used. The school principals gathered additional data (to survey the state of affairs and to further develop teaching applications in the school) which were available for the researcher.

The superintendent had an especially active role in the project throughout the five years, both in the schools and in the city council. His connections with the school authorities and computer agencies were important factors in the project and an aid to the researcher. The cooperation between the superintendent and the researcher was close and stable throughout the experimental period.

The principals participated in the in-service courses and their role in the project became ever more prominent the further the Project progressed. In the beginning, when the computers were new for them too, they were like the other teachers. Later, the number of different projects in many subjects, as well as integrated projects between the subjects, increased and computers were used only as a part of a project or not at all. As essential changes took place in the schools, and new arrangements and coordinations were needed, the principals became

leaders of the process.

3. Theoretic background

School improvement has many interactive facets. In order to give a general frame-work to a longitudinal study of school improvement we take as the basis three key aspects: (1) curriculum, (2) staff, particularly teachers, and (3) organization. Figure 3.1 presents the framework of school development:

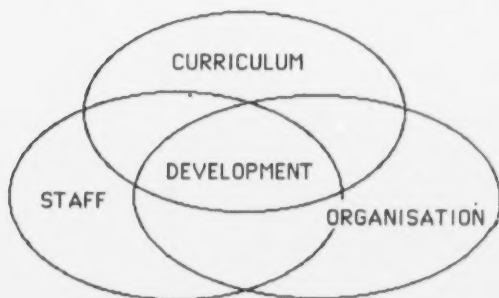


FIGURE 3.1. Key aspects of school development

Teachers regard curriculum as the main official regulation to be followed and textbooks as an official interpretation of the curriculum; in Finland the National School Board decides which textbooks are acceptable for use in school. In elementary school the position of the official curriculum has traditionally been less dominant but, on the other hand, in practice the elementary teachers base their teaching on the textbooks because of the many different subjects. From the be-

gining of the project one of the objectives was to have the teachers think that they can and have to develop the curriculum of their school. If they find that the "Basis of the Curriculum", laid down by the National School Board, e.g. does not emphasize some aspect they regard as important for developing their teaching, they can make improvements to the curriculum. The curriculum of the school can be flexible, but this implies that the teachers regard school knowledge as problematic. Knowledge is indeed a new critical element in the modern age, and a driving force behind the technologies and economies; but "the enormous pool of knowledge does not exist in schools, nor in the curriculum", "... it exists outside the schools" (Sharpes 1988, 5). It is a threat to the schools that their traditional and fixed knowledge form a segregate which has nothing to do with the students' knowledge and the practice outside the schools.

The second component of school improvement is the staff development. In the project it was regarded as the most important. The in-service education was the means to help teachers develop themselves as professional practitioners. That is a part of curriculum development too. It was realized that the main force for all development is the teachers, and it was also assumed that the teachers, in fact, want to develop themselves, their work, and the working conditions in the schools. What was needed was an initiative to do this, and encouragement and help when the process had started. In the project, teachers' personal development and collaborative development were emphasised, in particular.

The third component is often neglected in school improvements. It is necessary to form an infrastructure to organise and coordinate the plans and implementations of sequential phases. The organisational development of our project was flexibly planned: in some principle questions, the new ideas were emphasised in a top-down way by providing general

lectures and demonstrations and having meetings of the group of project leaders. But the practical questions of how to accomplish all the new ideas in school were left to the practitioners to be discussed, decided upon, and planned. What was needed and established as a communication network was the teachers' groups and the directive groups. It was left to the groups to plan the relevant in-service training, ask for in-service educators, consultants, equipment, etc.

3.1. Curriculum Development

Curriculum is a central concept in the systematic schooling of modern society. Most parents have their own opinions about the education school should give their children. They have certain priorities concerning good education. They know that what was good for them would also be good for their children. However, bigger reforms are seldom suggested, only slight modifications in some subject matter can be made. Curricular questions seem to be almost emotional for most citizens: love and hate are the extremes focussing on some content, subject or teacher.

As a topic of educational research, curriculum has typically been dealt with in two ways: either some subjectwise modifications in the prevailing curriculum have been proposed on the basis of research, or the philosophical basis of the curriculum has been analysed with a possible suggestion to reform it. However, few curricular innovations find their way into adopted practice. Especially the centralized national schooling systems, with their hierarchical administration, seem to be quite immune to all suggestions for real changes. On the other hand, administrative curricular changes have seldom changed teaching applica-

tions in any essential way.

In the first project report, different approaches to curriculum were introduced to the teachers in the way McNeil (1981) dealt with the topic. Accordingly, prevailing conceptions of the curriculum can be classified into four major categories: humanistic, social reconstructionist, technological, and academic. Those who have different orientations have also different ideas about what should be taught, to whom, when, and how. Even the very basic goals of education are different.

An academic orientation is probably the most general in Finland, and in this approach, curriculum is seen as the vehicle by which learners are introduced to subject matter disciplines and organized fields of study. Knowledge is defined as justified true belief, developed and tested by former generations. The approach has its origin in Greek philosophy and education: Trivium, the primary school curriculum, consisted of grammar, rhetoric and logic or dialectics; and Quadrivium, for the secondary school curriculum, consisted of arithmetic, music, geometry, and astronomy. When the sciences developed, these old curricula became more specific and step by step formed our subject matter disciplines. Though sciences develop indefinitely, it does not mean that the academic curriculum in school does the same. On the contrary, "the basics" as fixed contents in certain academic subjects, easily become "the basic knowledge" which dominates school teaching and learning: students have to adopt certain pre-fixed parts of the collective knowledge of the human race.

The humanistic curriculum is promoting new ways of knowing, and shifts the emphasis from the subject matter to the individual (McNeil 1981, 3). The curriculum should provide each student with intrinsically rewarding experiences, which contribute to personal liberation and development. Goals are dynamic personal processes related to the ideals of

personal growth, integrity, and autonomy. Aesthetic and moral goals are equally important as cognitive. Emotional relationship and reliance between students and the teacher are necessary to motivate students to learn. The teacher does not coerce students in to doing anything they do not want to do. The materials and teaching procedures should match the learners' willingness to do the school work. The learning process is more important than the product. Each student should attain self-awareness, awareness of his or her personal interests and capabilities. It is easily seen that the humanistic curriculum cannot be planned by a scientific community or school administrators, but rather it is the work to be done by the responsible teachers. Yet, some kind of official curriculum can be loosely followed.

Social reconstructionists are opposed to the notion that the curriculum should help students adjust themselves to fit in to the existing society. Instead, they conceive of the curriculum as a vehicle for fostering critical attitudes towards the present and for equipping learners with the skills needed for affecting social change. There are many different and even radical orientations within the social reconstructionist curricula, of which I personally prefer the Deweyan approach. Dewey (1916, 1938) proposed the so-called method of social intelligence, which means deciding what is right and best (instead of the traditional frameworks of values) through experimental procedures and the judgement of participants. Thus, becoming critical and creative was a major goal. The subject matter was important, but valuable only when it served the purposes of the learners. In fact, Dewey regarded subject matter as an endpoint, a formulated statement of experience (Dewey 1902, reprinted in 1964, 350). Hence, learners' active participation was emphasised in formulating the purposes of what was to be studied. Subject matter should become a tool for learners to use in understanding

and intelligently ordering their experiences. The curriculum should be organized around two concepts: that knowing is experimental and that knowledge is instrumental for individual and social purposes. Like the humanistic curriculum, the Deweyan social reconstructionist approach sets central demands on the teacher who has to arrange the learning activities in the classroom.

The technological curriculum is a rational approach to educational problems. The necessary first step is to decide upon the goals of education. This is usually done by politicians. After that, the goals are analysed in a detailed way into behavioural or empirical objectives by the curriculum experts. Then a scientific inquiry and evaluation of the means can be started: the procedure, material, or media are the best when the results of learning approach the objectives. Planning a curriculum is a question of testing different alternatives and choosing the best on the basis of the empirical evidence within the framework of the defined objectives. Of course, technical equipment (computer etc) and programs, video, multi-media systems, and other material which can be planned and tested in advance, are emphasised. The teacher should be skilful in using the materials correctly, choosing the best method to reach the objective, and evaluating the learning products. There are some problems in the technological curriculum which can be summarized in the following questions: Is it possible to define the objectives to every student in advance? Is it possible to specify the characteristics of the material to the extent of the teacher needs? How can learners' creativity be promoted? How can static goals and traditional achievement criteria be avoided?

No matter what the orientation to the concept of curriculum is, practical teaching is very often experienced as fragmentary. Even the educational goals or objectives and the content seem to have little in

common. In the age of "grand educational theories", such as Rousseau's, Fröbel's or Dewey's, education and social-political theory had kept in contact with one another and with philosophy. The concern was the cultivation of the "whole man" (Carr and Kemmis 1986, 13). It was R. Tyler who introduced a "scientific model" of a curriculum (1950) where the curriculum was explicitly seen as a means to given ends. There were discussions about the educational aims, followed by specialisation of objectives which, once agreed upon, allowed curriculum development to proceed. For defining the aims, Tyler suggested three components to be taken into account: (1) learners, (2) social conditions outside the school, and (3) subject matter specialists. After the objectives were defined, the other educational problems could be construed as technical problems to be solved by educational technology, e.g. as programmed instruction etc. As a consequence of this approach, each subject had its own curriculum, such as the mathematics curriculum, foreign language curriculum, mother-tongue curriculum and the like; and each subject had its own specialists, "subject didacticers" (Fach Didaktiker). Teachers became the implementers of subjectwise curricula, in other words, they became "makers" instead of "doers". The gap between theory and practice became wider than before.

The next step in the development of the concept can be the so-called curriculum system introduced by Goodlad. He had noticed that the language used by politicians, researchers and teachers was quite different concerning the ends and means of the curriculum. It was necessary to distinguish different levels of curriculum, such as "ideal curriculum", "formal curriculum", "perceived curriculum", "operational curriculum" and "experiential curriculum" which together formed the curriculum system (Goodlad and Assoc. 1979). We could add to the system the "hidden curriculum" introduced by Gordon (1957) and dis-

cussed in detail by Broady (1987). What was important was the obvious fact that the curriculum was originally planned and developed outside the school and teachers were only interpreters and implementers of the plans. However, teaching practice did not follow the development of the levels of curriculum outside the school. The "technical rationality", the belief in science-based rationality, and "reflective practice" can be seen as opposites (Schön 1983, 37 - 69). Technical rationality depends on agreement about ends: when the ends are fixed and clear, the decision to act according to them can be seen as an instrumental problem. But when the ends are confusing and conflicting, there is no clear problem to solve and no solution to be derived from applied research.

It was Stenhouse (1975) who started a new developmental phase in the concept of curriculum. According to him, it is important to have the teacher think about the curriculum development and behave like a researcher. "Teacher-as-researcher" was his slogan and it started the studies of teacher knowledge and how to influence it. Stenhouse emphasised that a curriculum is not a list of contents but

"a particular form of specification about the practice of teaching and not a package of materials or a syllabus of ground to be covered. It is a way of translating any educational idea into an hypothesis testable in practice", "... an attempt to communicate the essential principles and features of an educational proposal in such a form that it is open to critical scrutiny and capable of effective translation into practice." (Stenhouse 1975, 143.)

Teaching and curriculum develop together through the conditions of practice. The change is an answer to the problems posed in practice when teachers notice that the old practice is problematic because of students' lack of motivation or refusal. An individual teacher may suggest a new approach to the problem which usually makes many other

teachers oppose the suggestion, because it makes the old good principles questionable. However, in a democracy decisions are made collectively, which means that the teachers of the school reflect on and discuss the suggestion and the alternatives and even experiment with some new idea. The collective process is the core of the renewal. An individual teacher does not usually have the necessary power to change the curriculum. Starting from their own experiences and subjective theories, the teachers of a school can share experiences and change the curriculum. This is the Inside-out approach that D. Hunt has emphasised and experimented with in in-service education for several years, in Canada and also in Finland (Hunt 1987).

In our project we used Stenhouse's and Hunt's ideas of how to change the curriculum. We see curriculum as a community document which is planned by the teachers of the community. We have all reason to believe that this document is not just a written document separated from practice, but a plan which interacts with practice and develops continually. Sharpes (1988, 11) defines curriculum as the teaching act, not as a plan. We cannot agree because then the curriculum is individualistic, not something to be collectively reflected on in school. Schools suffer from the "culture of individualism" which not only determines the attitudes of the students, but also the social relations between teachers as well (Hargreaves 1982). We also think that our approach offers very good opportunities for the continual development of the curriculum. Necessary impulses may come from studies, experts, colleagues or other sources, but it is necessary that they are reflected in the school. Our approach is close to the teacher-based curriculum development which has been dealt with in detail, e.g. by Reid et al. (1987, 149 - 161). They have contrasted the traditional and teacher-based approaches (Figure 3.1.1):

Figure 3.1.1. Alternative approaches to curriculum development (Reid et al. 1987, 151)

STAGE	TRADITIONAL	TEACHER-BASED
Identification	Prescribed curriculum/ Forms of knowledge	Community based or pupil needs
Formulation	Behavioural objective	Process model & principles of procedures
Teaching strategy	Teacher centred, didactic	Enquiry/discovery ap- proaches, active learning
Production	Centrally produced curricula	Locally developed programmes
Classroom research	Quantitative analysis	Doing research in your classroom
Implementation	Fidelity	Mutual adaptation
Evaluation	Quantative, empirical and objective	Qualitative, illuminative and subjective

Figure 3.1.1 gives a clear picture of the basic differences between the traditional and teacher-based curriculum development in several crucial aspects or stages. Identification means establishing a clear purpose for the curriculum. Formulation refers to those new or old ideas which promise to fulfil the identified purposes. Teaching strategy means transmitting the content or arranging relevant learning activities. Classroom research and implementation refer to getting evidence of the effects of possible improvements. Evaluation refers to finding the final information and forming a judgement on how good the curriculum was

after it has been implemented for a period of time.

3.2 Staff Development

There may be neither curricular nor teaching development without teacher development, and usually no teacher development without felt needs for development. Only teachers can create good teaching, and thus it is imperative that they occupy a central role in developing the curriculum and that they develop with the curriculum (Reid et al. 1987, 161). People change organizations. "The starting point is not system change, or change in those around us, but taking action ourselves", says Fullan (1986). School development has to be habitual. It is a question of combining continuous improvement with the resolve to be 'regularly irregular' (Holly and Southworth 1989, 131). It is a curious amalgamation of constance and change.

Untill the early 80s, most of the school reforms were content-oriented rather than process-oriented. Dalin (1978, 9), in his classical school development study, emphasised the importance of a systematic process orientation which would include the following:

- (1) Looking upon change as a process involving political, economic and social interests.
- (2) Seeing the school as an integrated part of a network of central, regional and local interests.
- (3) Understanding the school as an organization involving conflicts over values.
- (4) Managing a complex interplay between human relations and organizational structures.
- (5) Understanding leadership patterns and role relationships.

(6) Dealing with the security of individuals and their incentive structures.

(7) Creating conditions for the development of new skills at all levels of the system, not only skills in the content of the innovation itself, but also skills in planning, development, monitoring and evaluation.

(8) Seeing change as a problem of institutional linkage, institutional conflicts and institutional survival.

The 80s have been a decade of searching for solutions for these process aspects.

A teacher's work, competence and expertise could be seen, roughly speaking, from two aspects: the teacher is a person who (1) is able to implement the curriculum as defined by external bodies (e.g. politicians and subject-matter experts) and (2) has a central decision-maker's role in school settings, who participates collaboratively in planning, and shares authority and responsibility with various other educational bodies (e.g. school administrators, school boards etc.). Our philosophy in the project was that the schools must have the right and the responsibility for developing the internal capacity for change in a wide meaning — the cultural change in their school, including e.g. curriculum development. What is essential, according to Fullan (1986), is a critical screen, or shifting mechanism, to make learning and development work more focussed and more purposeful. An organization becomes healthy through the efforts of its members. The emphasis of teachers' in-service education should be on exploiting the school's natural resources for the change. Thus, in-service education should be more than "receiving new information". We recognized Berman's and McLaughlin's extensive study of effective and ineffective strategies in school developments:

Figure 3.2.1. Effective and ineffective strategies in school development (Berman and McLaughlin 1978, vi - ix)

Effective Strategies

Ineffective Strategies

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- | | |
|--|--|
| 1. Concrete, teacher-specific, and extended training | 1. Packaged management approaches |
| 2. Classroom assistance from project or district staff | 2. One-shot, pre-implementation training |
| 3. Teacher observation of other similar projects in other classrooms | 3. Pay for training |
| 4. Regular project meetings that focus on particular problems | 4. Formal evaluation |
| 5. Teacher participation in project decisions | 5. Outside consultants |
| 6. Local materials development | |
| 7. Principal participation in training | |
-

Though the study was made in the 70s, the message is still clear: the new, school- and individual-based Inside-out Strategy is more effective than the old, "information delivery" or Outside-in Strategy (Hunt 1987, 128).

Hunt has developed a meta-theory and an organization of the needed procedures of how teachers' own professional experiences and subjective teaching theories can be taken as the basis of teachers' in-service education and professional development. The main idea is to have teachers identify their own theories and teaching styles, discuss them

with their colleagues and a consultive researcher, understand their colleagues' possibly different approaches and thinking, concretise different aspects, and apply these in different situations. In this process teachers act like researchers and researchers can act like teachers. Working together, both practitioners and theorists can learn in the process: reflect on and understand their own implicit theories of practice (reflexivity), understand formal requirements and implicit theories of practice (responsiveness), and notice how to develop and sustain a reciprocal relationship with each other (reciprocity) (Hunt 1987, 132 - 143).

Hunt also realised the fact that all aims and principles are more effective when they can be expressed in short slogans or "stingers", because then they activate and carry on larger thought complexes and help communication. For instance, we expressed our main idea of the use of microcomputers in the project with the aid of the stinger "The computer is a tool!".

Fullan's recommendations to a reasearcher or a manager of school development are as follow (Fullan 1986):

- (1) avoid the rationality of "brute sanity"; do not impose your bright ideas on those who do not consider them to be bright ideas,
- (2) avoid innovation overload,
- (3) be flexible in implementing the implementation plan,
- (4) attend to both content and process,
- (5) use pressure and support to effect changes, and
- (6) remember that 'change' is a learning process.

As a consequence of the previous studies, the following principles were used in the in-service education of the Project (Leino 1987b, 11):

- (1) In-service should be intensive and concrete.
- (2) The teachers' ideas have to be encouraged and have to become the

focus of the in-service education.

(3) Because the aims and working habits of the teachers of different subject fields differ from each other, this diversity has to be regarded as a richness and should be supported in small-group discussions and workshops.

(4) Local, subject-wise and group-based solutions were preferred to standardized ones in the possible development of materials.

(5) In-service education should emphasise the teachers' own activity.

In addition to these principles, it was decided that the in-service education should be sequenced annually in a continuous process throughout the experimental years.

Self-evaluation, collegiality, individual styles, internal improvements, professional reflection, and co-operation with external support partnership were important aspects in staff development throughout the project (see Holly and Southworth 1989, 139).

A major change, during the 80s in the planning and designing of in-service education, was the shift of responsibility away from local educational administrators towards schools. This means, as in the schools of the project, that planning and designing are a part of the staff development. Of course, the process should be organized — and that will be dealt with in the following chapter — but from the viewpoint of the learning process, this is essential: when the teachers of a school plan their own in-service education, they take the responsibility of their own professional development and make in-service education a tool in this process. The initiative for learning is theirs. Simultaneously, they also become involved in several aspects, e.g. time, space, instruction, aims, sequencing, organization etc, of school development. All this requires the teachers to know how to examine their work, individually and collectively (Shanker 1990). Another goal of the project was how the

in-service education occurred: each year the teachers' groups planned and designed their in-service as projects and this so called "project-study" became a stinger of the project. Teachers were also encouraged to use "project-study" in classrooms as well.

Leithwood (1990) has presented three dimensions in teacher development: (1) psychological, (2) career cycle, and (3) professional expertise. Each dimension consists of hierarchical stages of development. Psychological development means a personal development process in which a person strives to master, integrate, and otherwise make sense of experiences. Greater maturity is associated with a more complex and better differentiated understanding of one's self in relation to others. Moral development occurs on the basis of which, one's views of rightness and goodness shift from personal preferences toward universal ethical principles. Career cycle development begins from the stage of launching the career, then stabilizes to mature commitment, then sets new challenges and concerns, and finally reaches a professional plateau preparing for retirement. In the dimension of professional expertise development, Leithwood presents six categories: survival skills, becoming competent in the basic skills of instruction, expanding one's instructional flexibility, acquiring instructional expertise, contributing to the growth of colleagues' instructional expertise, and participating in a broad range of educational decisions at all levels. The third dimension is crucial and the most interesting in our long project.

3.3. Organization Development

A school is an organization and a part of a larger organization. Educational systems have often been structured and managed according to organizational models taken from other sectors in society. These models reflect certain models of man and certain basic assumptions about how organizations ought to function. The way education is organized is an important factor in determining its capacity to cope with change (Dalin 1978, 39). The ability to cope with changing demands may be hampered by the nature of the organization itself. The present organization has been developed to serve the goals which are regarded as valuable, but it can also be a barrier if the function of education is changing.

It is not necessary nor relevant to discuss different models of organizations in detail here, because the purposes of the project lay in other aspects. However, the implementation of the project brought some new features into the previous administrative practice and, hence, a short description of the Finnish school system is needed. In Finland, like in many other countries, one can distinguish three hierarchical levels in the educational administration: (1) national, (2) regional, and (3) local. Traditionally, our national education policy has been bureaucratic and centralized according to the classical organization theory (Leino 1984). Though the official policy has attempted to give the regional level more decision power, its role can still be regarded as bureaucratic and controlling, only slightly initiative and supportive. The local level has been encouraged to suggest new solutions and find their own ways to answer the educational problems. Thus it is the local level and especially the staff of the schools which have taken the initiatives to make changes in many communities. On that level, the organizations are

more like social systems or open systems than bureaucratic ones in the classical sense (see Hanson 1979).

Many studies of school development have shown that a vision of a better functioning school is helpful and even necessary for changes. By distributing freedom and responsibility to principals and teachers their motivation increases and the organization can convey the controlling people's capacity for productive work (e.g. Bennis 1989, Ouchi 1981, Peters and Austin 1985). What is needed is a clear image of how the ideal school functions and what it then looks like. If the staff has a common vision of the ideal, an individual member of the staff can contribute his or her suggestions to the others to be reflected on collectively within this framework. The consequences are to be seen in the climate as well as in the teachers' satisfaction and students' achievements. Professionals, who express positive feelings about their working conditions, also appear to be more productive workers. Of course, "good practice" requires that the situational factors, the practitioners, the management of the process and the results, are taken into account.

Management of a project involves procedures and structures for coordinating diverse activities, which are intended or needed to carry them out. It is not possible to plan all activities of a long project in advance. What is needed is the direction of the activities. The model of rational planning — such as identification of needs and priorities, planning and designing the in-service education, implementation and follow-up of the activities, evaluation of the results — can offer only a frame within which each stage has to be carefully and flexibly re-planned. A good staff development programme tends to exhibit a collegial, participative style of leadership, where senior staff work as a team and are ready to

- consult staff about needs and priorities
- delegate significant responsibilities
- encourage staff ownership of inservice education
- invite open review of processes and activities
- identify and use talented staff to lead in-service activities
- network good practice between groups within the schools
- lead, through example, by they themselves engaging in their own professional development
- contribute towards a positive climate by offering professional support and personal counselling to staff (Oldroyd and Hall 1987, 11).

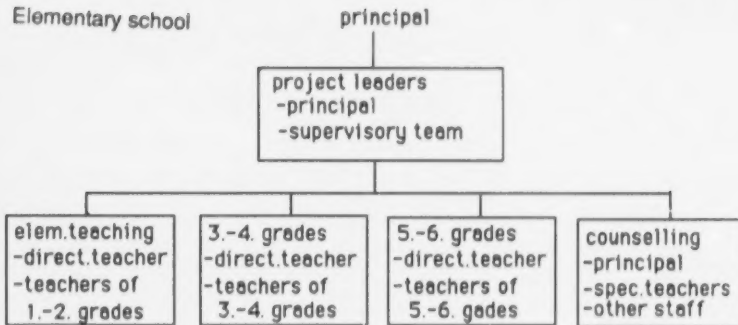
The goals of the project emphasised the personal development of the teachers and principals, collaborative development in the form of working groups, and collegial development which could move to a systematic assessment of institutional needs. The first phase consisted of learning the skills to use computers, the second phase of a collaborative decision on how to use computers in the teaching of different subjects, and the third phase of how to plan the needed in-service education to carry out the decision. The following phases repeated the cycles of planning-and-implementing of small projects, and moved the activities from computer-use to more general aims of instructional development involving e.g. increasing students' active learning by the project-study method, integrating several subjects for a certain learning period etc. As the final phase, we can regard the situation where teachers are involved in the organizational functions of the school in a creative way. As reflective practitioners, they are also then able to evaluate the quality of the instruction and the assumed effects of alternative solutions.

In order to manage all these stages, a group of project leaders was established consisting of the superintendent, the principals, a repre-

sentative of the teachers, of the Local as well as National School Board and of the Ministry of Education, and the researcher and other experts. Another staff group, a so-called a supervisory team to coordinate the activities, was also established in each of the schools. The 5 to 6 members of the team were teachers' representatives of different subject fields (general subjects, mathematical subjects, foreign languages, and practical subjects) or elementary school teachers (two groups). The directing teachers chaired the group meetings and in-service courses. The organization on the project in the schools is presented in Fig. 3.3.1.

The decision power of the teachers' groups was increased in planning and implementing the in-service education, including as well the use of funds (budgeted by the City Council). The groups also surveyed the money needed for new instructional equipment and materials. The supervisory team made the final suggestion regarding these monetary issues. During the experimental period of the project the teachers also established voluntary meeting groups to discuss experiences and agree on new common efforts.

Elementary school



Junior and senior secondary school

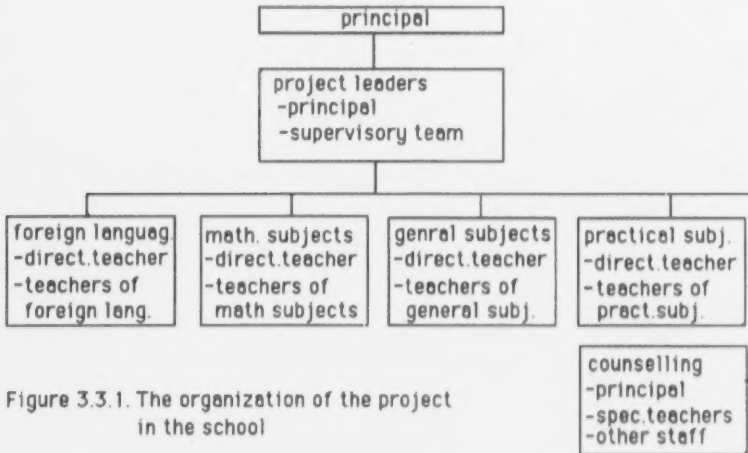


Figure 3.3.1. The organization of the project
in the school

Because a healthy school interacts with its environment, special emphasis was laid on having the support of the parents and the City Council. In the annual meetings of the new School Boards, the basic ideas and stages of the project were introduced, discussed and further developed in workshops. The School Boards formed an important support unity in the support structure of the project.

The development strategy of the project was participatory-local (Dalin 1978, 107), in which the main limitation was the lack of

large-scale dissemination of information to the Finnish school system. The dissemination aspect was taken into account annually by direct contacts with national school authorities, introducing the project with the aid of reports, papers and discourses, and creating close contacts (personal and electronic) with several other developmental schools and their teachers. The project was introduced in several meetings of teachers, principals, and school administrators over the years. The schools involved in the project frequently received groups of visitors (school administrators, researchers, teachers) from Finland as well as abroad.

4. Reasearch Method

When a researcher faces the situation in which he has to choose a scientific method to solve a complex problem, it is possible that he does not think in a rational way. There is no clearly stated goal of the study which would determine the best method. Instead, there are the researcher's interests, his reflections on the nature of decisions, the value of the goals, and the implications of the actions. This is what Schön (1983) noticed when he analyzed the work of architects and other professionals. It is not a cognitive process of selecting a method among the alternatives, but an appreciation process of problem setting.

School and teacher development is a complex task, not a technical one if the researcher regards the teacher (at his or her best) as a critical and reflective practitioner who is interacting with changing situations in a continually changing context. It is also probable that the teacher's knowledge does not primarily come from pre-service education nor outside sources, but from the teacher's own interpretations of his or

her everyday experiences. If the task is to support teachers' professional and co-operative development, then it is not possible for the goals to be well-defined, and thus the orientation towards the knowledge interest cannot be technical (in the meaning by Habermas 1974).

A researcher wants to improve the state of practice in the field of his (or her) study. A positivistic researcher views educational reform as technical, and believes that it is possible to give teachers a theory to be applied. But teachers could not even begin to deal with the practice without some knowledge of the situation in which they are operating, and some idea of what it is that needs to be done. They already have a kind of situational theory combined with the values of what is worth doing in that situation. Thus, they have difficulties in fitting the researcher's theory into their own. An interpretive researcher tries to reveal the meaning structures governing the situation and individuals in it. He hopes to change the practice by changing the ways in which they are understood. The "right" way is usually the researcher's, which he offers as help in solving the problems of practitioners. It may help, but it may also be as difficult for the practitioner to adopt as the positivist's theory. Thus, the practical interest of knowledge is not enough, even though it is one step in the right direction.

Habermas (1974) offers a third knowledge-constitutive interest to guide and shape the way knowledge is constituted in human activities. His third interest is called emancipatory, and is based on the reflection of the factors in a situation within the social-historical framework. It is the critical social sciences which offer the emancipatory interest. Its method is that of critique. Its epistemology is constructivist, seeing knowledge as developing by a process of active construction and reconstruction of theory and practice by those involved (Carr and Kemmis 1986, 148). If we hope that teachers become researchers into their own

practice, then a critical social science offers the best scientific approach. The method of action research, in the form introduced by Carr and Kemmis, seemed to be relevant for the purposes of the present author.

Action research is a form of self-reflective enquiry, undertaken by participants in social situations in order to improve the rationality and justice of their own practices, their understanding of these practices, and the situations in which the practices are carried out (Carr and Kemmis 1986, 162). It has been employed in school improvement, curriculum development, professional development, school improvement programmes, and systems planning and policy development. In terms of method, a self-reflective spiral of cycles of planning, acting, observing and reflecting is central to the approach. Kurt Lewin (1952) described action research in terms of planning, fact-finding and execution:

"For one reason or another it seems desirable to reach a certain objective... The first step, then, is to examine the idea carefully in the light of the means available. Frequently more fact-finding about the situation is required. If this first period of planning is successful, two items emerge: an 'overall plan' of how to reach the objective and a decision in regard to the first step of action. Usually this planning has somewhat modified the original idea. The next period is devoted to executing the first step of the overall plan."

During the cycles the planners have opportunities to learn, to gather new general insights of the strength and weaknesses of certain activities and to modify the plan for the next step.

A critical researcher sees knowledge as socially constructed through social interaction with others. This knowledge is determined by the surrounding culture, context, customs, and history through the

practitioners who interact with and interpret the situations. In the educational settings we are describing, the teachers of the experimental schools ask questions, analyse, and draw inferences about their experiences in the in-service courses, meetings and classroom events. They have their own pedagogical theories which act as a framework for new experiences, help them make sense of what is going on and guide further actions. The teachers were expected to discuss, create new directions, choose, and experiment with new teaching equipment and methods, and evaluate in groups the intended and unintended consequences and implications of various solutions. The researcher's job was to find the facts, present the theoretical background for interpretations, inform the teachers (and other participants) of the facts and negotiate with them about the plans for the following step.

Action research is research for action and change. It works effectively on many levels, from the classroom to the statewide system, and on diverse issues, such as learning and management. It is based on the premise that when change comes from within an organization, it is internalised. It emphasises collaboration and empowers teachers to create new roles, and thus increases the professionalism of teachers. It combines practice and in-service education and provides continuity. It produces evaluation data generated by the teachers. One of the important points is that the evaluators are the practitioners. If an outside researcher wants to be among the evaluators he (or she) has to see the situations from the point of view of practitioner and researcher, and see the evaluation as a kind of "self-evaluation". Action research also allows parents and students to evaluate the change process. It means a direct interaction between researcher(s) and practitioners.

Action research includes at least the following phases: 1) planning to improve current practice, 2) action as the implementation of the plan,

3) gathering data of effects, and 4) reflecting on the results as a prelude to further planning (see e.g. Winter 1989, 12). The essential point in each phase is the use of changes in practice as a way of inducing improvements into the practice itself, the situation in which it occurs, the rationale for the work, and understanding of all these. The data-gathering can consist of detailed diaries, documents, observation notes, questionnaire surveys, interviews, shadow studies, tape- or video-recordings, photographs etc.

5 Problems and Data Gathering of Study

The general task of the study was to answer the following questions:

1. How did the school develop during the experimental years? and
2. What was changed in the school work by the end of the project?.

Though the ultimate criteria of the intended change was the work in classrooms, the change actors were the staff. We concentrated on the teachers and principals, as well as on the superintendent, in order to answer the above questions. We thought that, in order to have changes, it was necessary that the teachers worked together, shared their experiences, thought about and discussed what kinds of improvements were needed, what was possible, how new ideas worked in practice, what problems might have appeared, what kind of help was needed, etc. Thus, the original questions were modified to comprise questions of whether the teachers actively participated in the process of articulating, analysing, and hypothesising solutions to complex educational problems, whether they experimented with new solutions, whether they collaboratively reflected on the results, regarded it as

necessary to change the curriculum, comprehended in-service education in relation to school development, etc.

An additional problem of the study was the question of

3. How can educational research influence teaching?

Traditionally, researchers conduct their studies and publish the results in articles or monographs, and assume that practitioners or educational administrators apply the results in practice. However, it is a well-known fact that the assumption is unrealistic; the chain from research to practice somehow breaks down because of the difficult language of a scientific report, different conditions, etc. In fact, researchers may observe that they only inform other researchers. In the present study an attempt was made to gather experiences of the possible effects of action-research in practice. Several researchers have recommended action-research as a useful and important way to change the practice (e.g. Carr and Kemmis 1986, Winter 1989). Though an action-researcher works only in a couple of schools and can help the practitioners there, the influence can expand much faster to other schools through the participants of the action-research than through the scientific reports.

Each experimental year had its own partial goals and these have been presented as the problems of the annual reports. In order to avoid long lists of the special problems of the five experimental years without giving the results at the same time, I will not present the problems until the chapter dealing with the results. The chapter of results is divided into two parts: first, each year will be described separately including the special problems and their results, and then the project as a whole will be dealt with in terms of looking back at the end of the fifth year.

The data, on the basis of which the answers to the problems are given, are basically teachers' reports, inquiries, and interviews. We participated in the major meetings of all teachers, and the meetings of

the group of project leaders, and received the minutes of the meetings. Especially in the elementary school, many teachers often extended an invitation to follow the students' projectwork and gave copies of the students' collected works for the small projects. Similar projectwork was also received from several secondary school teachers.

At the end of the project the reports of the teacher groups describing the whole 5-year period were collected, and the superintendent and the principals were interviewed. The structural basis of these reports and interviews was the same:

- a) What happened throughout the years of the project and how was the process experienced throughout the years?
- b) What procedures and ideas of the project would you recommend to other schools?
- c) What could have been done differently?
- d) How does the future appear?
- e) What position have modern technology, project-method and other new methods attained?

Of the several small projects carried out during the experimental period, "The Future School" should be mentioned, a big project in which the present author personally participated. This project was financed by the biggest newspaper in Finland. Three different schools participated, one of them from the U.K. The project included a summer school and an exhibition, all described in a special report (Tulevaisuuden Tekijät 1989).

The project was introduced to different audiences and visitors and most of these introductory papers and videos could be used as an additional source of information. One of the major problems in a long project like ours is the enormous amount of information the researcher accumulates. To categorize, select, and generalize becomes a must.

6 Results

The school as an educational institute and the system of teachers' in-service education in our community were very much like those in other communities. At the end of the experimental period, the superintendent described it as follows:

"Five years ago we had three schools where an individual teacher worked in "pedagogical freedom", almost independently from others in his or her own room without any co-operation with others. That was the teacher's working model. The teaching model was going through the textbook; all equipment and materials in the school served this model."

Teachers usually worked alone and teaching was strongly dependent on the officially accepted textbooks.

Teachers' in-service education has been compulsory since the 70s, but the effectiveness of those three days a year was minimal according to the studies. The superintendent of the community verifies it:

"As to the in-service education, all kinds of activities and willingness for in-service education were encouraged: "Leave your home and learn new things!" ... One cannot even speak about the effectiveness of in-service education. Teachers were only learning that in-service education was a part of the job. The early 80s was a golden time for textbooks and teachers' associations: the authors of a textbook told us about the new 'scientific' ideas to be included in a new edition."

The school administration was experienced as centralised:

"If any activity, material or equipment was new, permission to use it was applied for from the School Council".

Such a practice is still very typical in most communities in Finland.

Before the first experimental year (summer 1986), the teachers were

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asked about their expectations concerning the use of computers, previous experiences with microcomputers or similar equipment (typewriter with memory and display, electronic calculators, terminals of a central computer), and things that may have made it difficult for them to use them or even prevented their use in school. Only 10 % of the teachers had previously used microcomputers quite often and 15 % several times; over half had never touched a microcomputer. Typewriters with a display were also quite unknown, three-quarters had never typed on them and only 3 % were used to them. Pocket calculators were used quite often by three-quarters of the teachers; one-fifth had not used them. Only 10 % of the teachers were familiar with the terminals of central computers, the use of which had been a part of compulsory course requirements in teacher education for over ten years.

The expectations concerning the use of microcomputers in school were heterogeneous: the most frequent expectations were "introduction to computers or programming instruction" (21.9 %) and "record keeping" (21.9 %), "motivating students to study" (17.2 %) and "for above-average students' special applications" (15.6 %). "Drill-and-practice programs" were not favoured (only 12.5 %) among the teachers' first choices, neither were "management activities (producing tests, complementary texts, transparencies etc.)" (9.3 % of the teachers). The ranking order of the expectations was rather similar to the factual usage expressed by American teachers (Becker 1985, 1987).

Of the difficulties or hindrances which the teachers saw in the use of computers in school, the most frequently mentioned was "the time needed for learning to use computers" (32.8 %). The second difficulty of the top of the list was "the lack of suitable programs" (25.4 %) and the third was "the difficulty in using computers in whole class teaching" (22.4%). Also "the lack of time" in school or "the inflexibility of the curriculum" (10.4 %)

and "the small number of microcomputers for teaching the whole class" (9.4 %) had high percentages. The teachers' first difficulty may express the worries and insecurities they felt; it depended on the level of demands they had set themselves. The second, third and fifth difficulties show that the teachers especially think in the same way about teaching the whole class together; teachers are in a hurry when dealing with the details of the textbooks. The difficulties reveal quite well how the teachers interpret the curriculum.

6.1 Results of Experimental Years

6.1.1 First year

In order to describe what kind of development occurred, we will first deal with the experimental years separately and then as a sequential whole. As was told above, we started the project by introducing microcomputers and offered the teachers an opportunity to become familiar with the use of them in teaching. The idea was that computers would be interesting enough to have the teachers voluntarily participate in the project and that the pedagogical use of computers would be experienced complex enough to bring out conflicts between the old practice and the new demands. These conflicts could make the teachers think about what kind of school, curriculum, and teaching their students need, and what kind of role the teachers have in this developmental process of school. The project and all the annual reports were entitled "The Computer — A Tool For Instructional Development", with proper additional subtitles. The focus was on instructional development, but it was assumed that this would bring about staff development as well as organizational and curricular development.

We distinguish the two terms of the first academic year because each of them had clearly different characterizations and different plans for in-service education. The results were also reported separately (Leino 1987a, Leino 1987b).

Fall 1986: The problems of the first part of the study were as follow:

- I.1) What were the teachers' attitudes towards the in-service training and how was the first course experienced?
- I.2) What kind of suggestions did the teachers have for using computers in teaching after the course?
- I.3) What differences were there among the teachers of different grades and subjects in their attitudes towards the use of computers and in their suggestions concerning their use?

Before the project began a heated discussion arose in the schools concerning the type of computers to be bought. There were two alternatives, IBM-compatible or Macintosh. The decision was postponed until the teachers had gained concrete experience during the training. Hence, the final problem of the first report was:

- I.4) How did the teachers experience the training courses regarding the use of two different operation systems?

All teachers and principals ($n = 71$) of the experimental schools were willing to participate in two 3-day courses (during working hours and free of charge), the first of which concentrated on Apple-Macintosh and the second on a MS-DOS, IBM-compatible system. The schools had a few of the latter type and the former type had just appeared on the market. Hence, the schools decided to experiment with the Apple-Macintosh, because of its user-friendliness. The second 3-day course was a continuation of the first and also consisted of carrying out the teachers' own plans as to how to use microcomputers in teaching. In-service education took place in small groups formed on the basis of both school level and subject-matter.

Thus two groups of elementary school teachers and four groups of secondary school teachers were formed. Each group had 8 to 12 teachers. The secondary school teachers were grouped as follows: mathematical subjects (maths, physics, chemistry, computer science, business), foreign languages (Swedish, English, German, French, Russian), general subjects (history, economics, geography and biology, religion, psychology, mother-tongue teaching), and practical subjects (fine arts, music, textile and craft, home economics, physical education). In Finland, a secondary school teacher has usually studied two or three subjects; e.g. a maths teacher also teaches physics and chemistry or computer science / informatics. (Computer science is called information technology in school.)

The first in-service course started with two graphic programs (MacPaint, MacDraw) and continued with a word-processing program (MacWrite). Combining texts and pictures was also done with a special program (PageMaker). The teachers were asked to prepare texts and pictures for their own teaching or to plan a class newspaper etc. Each teacher had his or her own machine and the training occurred under the leadership of two educators in three groups of 23 - 24 teachers (by joining two of the small groups mentioned above). On the third day some animation and music programs were demonstrated, but otherwise in-service education consisted basically of the participants working on their own; the educators provided the terminology needed for communication during the day; frontal teaching was avoided as much as possible.

The second 3-day course took place one month later and concentrated on MS-DOS tool programs. At this point the in-service education was organized in six small groups. Depending on the group, the use of different tool programs (WordStar, TeleCalc, LOGO, Windows, DataBase) were practised. The operating system was more complicated than on the first course, but the educators attempted to emphasise the analogy of the

operations of the two machine types. More lectures, demonstrations and discussions, and less practice may describe the second course compared with the first. Pedagogical issues, e.g. what kinds of possibilities the teacher have for using tool programs in the classroom, were emphasised more in the second course. After each course, a short questionnaire was administered to find out how the course was experienced.

The first course gave teachers experiences of satisfaction and enthusiasm. "It is easy to learn to use computers", "Even the old can learn to use computers", "The first really rewarding in-service course!" were the most typical statements. The number of positive comments was twice as numerous as the negative ones. Especially the elementary teachers were highly enthusiastic and thought that their pupils could also learn to use the mouse and the computer. However, a new terminology and a great number of details were mentioned as one of the difficulties (40.6 %) and learning basic routines (28.2 %) as another. Three-quarters of the teachers gave a positive judgement when additional comments were requested. Many secondary school teachers mentioned as a drawback the fact that they were not taught how to use these tool programs in the classroom.

The experiences concerning the second course varied a great deal. Some groups of secondary teachers regarded it as highly rewarding, but others criticized it strongly. The operating system was the biggest difficulty (57.9 %), but also the terminology and the number of details (31.6 %) were experienced as difficult. Most of the teachers (58 %) regarded it as positive to become acquainted with the two types of microcomputers; still a great number of the teachers (39 %) regarded it as confusing. Table 6.1.1 presents a summary of the experiences of the teachers.

Table 6.1.1 The experiences of the teachers (n = 71) in the two in-service computer courses (Macintosh, MS-DOS)

	1. Course (Macintosh)			2. Course (MS-DOS)		
	Content	Methods	Results	Content	Methods	Results
It was OK	38.2	26.5	44.8	31.0	39.6	75.0
Slight criticism	41.2	42.6	52.3	17.3	34.5	20.4
Some difficulties	13.2	23.5	3.0	31.0	20.7	2.3
Many problems	7.4	7.4	-	20.7	5.2	2.3

The first course contained more practical activities and was more favoured than the second. It is not possible to attribute the differences in the popularity of the courses to the computer types used. The courses were different in many respects. However, some teachers also expressed their preferences for the different types: all elementary teachers who did it (26 %) preferred Macintosh to MS-DOS and of the secondary teachers (20 %), some 40 % preferred Macintosh and 60 % MS-DOS. The results obtained so far give an answer to problems I.1 and I.4.

After the in-service courses the two types of microcomputers were placed in the teachers' working rooms in the schools. A record was kept of the times the machines were used and the purpose. The lists showed that Macintosh computers were used daily by many teachers and MS-DOS occasionally by only one teacher. The purposes varied from preparing test sheets, lists of students, letters, transparencies etc. to mere practising. Mostly the use of the microcomputer had replaced the typewriter because of the need for special texts (of differing size or type) or for drawing.

In order to answer problems I.2 and I.3, the teachers were asked to make a small plan of how to use microcomputers in teaching. The preliminary plans of the elementary teachers consisted of continuing working with tool programs (word processing, graphics) in different subjects and discussing the pedagogical issues involved. The secondary teachers had subjectwise plans of becoming familiar with and starting to produce

databases (in general subjects), producing databanks of exercises or tests and small drill-and-practice programs (in mathematical subjects), using authoring language and producing small drill-and-practice programs (in foreign languages), using tool programs (in music), producing a program which could automatically compute the nutritive components of foods (in home economics) or calibrate the sporting results in terms of the students' age, gender etc. (in physical education), making visual models of perspectives (in fine arts), using recreative games (in mother tongue teaching, foreign languages, mathematics), and using spreadsheet programs (in business and mathematics).

The list above is a good example of the great number of differing ideas the teachers could produce on how to use computers in the classroom. Of course, some of the ideas could have been implemented easily, but some would have required a lot of technical help and programming studies too. The elementary teachers first wanted to continue practising tool programs and then to discuss pedagogical problems. The secondary teachers' suggestions were more specific and made from the point-of-view of how to make learning more effective or motivating than before. The differences of the attitudes between the teacher groups were small: hardly any directly negative attitudes appeared towards the use of computers in teaching; only the ways differed.

The first report (Leino 1987a) described the details of the beginning of the project. The readers of these annual reports are assumed to be the teachers of the experimental school and those outsiders who were interested in developing their own or other educational institutes. The theoretical background dealt with different conceptions of the curriculum, the roles of instructional materials, and the experiences of using computers in school. The author hoped that the teachers would view the curriculum from many angles and even change the official curriculum, if

they found it necessary in order to use computers. Some former studies had shown that if e.g. word-processing was used in learning to write, then some partial skills would be better learnt (see e.g. Konttinen et al 1986) and, hence, it would suggest curricular changes.

Spring 1987: After the initial orientation course, the next phase of the project was an attempt to have the teachers use computers in teaching. In order to develop teaching practice, we started with the teachers' implicit theories of how they would include microcomputers in their repertoire of teaching methods and encouraged them to discuss and reflect on their ideas in their own group. Because many groups had several suggestions about computer use after the orientation course, each group was asked to agree on one suggestion of how to use the computer in a small learning project of 2 to 6 lessons, to be the focus of the following year. The suggestions were ready in February.

In order to have the teachers internalise what it meant to carry out the suggestions, they (group-based) were asked to plan the appropriate in-service education (of the six days for the following academic year). This demand belonged to a world unknown to usual school practice. Teachers, at least in Finland, are used to expecting that very practical programmes (new instructional materials etc.) and relevant in-service education are given to them if society demands some reform. That they were asked to plan their own in-service education and carry out their suggestion for computer use in the classroom was so new that they resisted immediately. "This is not our job!", "Who is paid for this?", "I'll move to another school!", "What in-service education can be, what contents, I don't know!" were typical reactions in the teachers' working rooms, as one of the teachers, later described the situation. It took two months before some teachers got an idea of what it could be, and the

groups accepted the idea of planning their own in-service. When the group of project leaders allowed the groups to use "one whole day" (of the six in-service days) for making the plans, one group decided to do the job and, afterwards told, the other groups that "It was not as difficult a job as we had expected".

The deadline for the plans had to be postponed six times, but at the end of the spring all groups had prepared acceptable plans. "An impossible thought, according to many, of planning one's own education, had been carried out. It has been upsetting to notice how suppressed, top-down steered, we have been; always willing to accept the ready-made schooling", wrote the same teacher as mentioned above. "We have now been shaken and woken up, we cannot become ossified."

Spring 1987 meant a turning point in the school culture, the beginning of a new professional development for the teachers. All the teachers experienced the period of in-service education that they had planned themselves as highly rewarding. Co-operation in the groups had started and the discussions turned from computers to such important questions as "What is dynamic knowledge?", "When is learning active?", "What is project-study?", and "What are relevant teaching methods for the purposes?". One of the key ideas of the project was that, though creative thinking is mostly individual, collective support is needed to significantly change the work in a social organization.

At the end of the spring term, the teachers were asked what had been most difficult in planning the in-service education courses. The elementary teachers mentioned that they did not get sufficient information of what the goal of the second phase was and how to begin; they did not know how to plan schooling, what to do with computers and programs. However, a computer classroom of 6 machines (Macintosh) had been intalled in the elementary school, and some pioneer teachers had organized (with the

parents) extra activities for the students. Thus, several elementary teachers had positive experiences of using computers in the classroom. They also got their plans ready earlier than the others. The secondary teachers complained of the lack of time, help, information about the goal, organiser, knowledge basis, and ideas. They asked "What is a project-plan?" and "What is a project?". Some teachers admitted that to concretize one's own objectives was the toughest part. In summarising, we can say that planning one's own in-service education on a topic for which the knowledge basis was insufficient and experiences minimal created anxiety and even caused anger for many teachers. Part of this was due to the vagueness of the information given but mainly, as an idea, the requirement was too strange. The group of project leaders encouraged the teachers to contact consultants, experts, and those teachers who had experimented with computers in teaching, but did not give additional information about the ways how computers could be used in the classroom or specific requirements concerning the in-service courses.

Report 2 of the spring term concentrated on the teachers' internalising process of the pedagogical uses of computer, i.e. staff development. The problems were as follows:

- II.1 What ways of using computers did the teachers suggest and how did the suggestions differ between different groups?
- II.2 How did the teachers experience planning their own in-service education?
- II.3 What contents and methods did the plans consist of?
- II.4 How did the teachers see the development of the school; what directions and demands had they noticed?

The theoretical background consisted of theories and studies about school development, the latter including the role and form of in-service education. The RAND study by Bergman and McLaughlin (1978) and the

'In-side out' -strategy by Hunt (1986) formed the starting point as well as the ideas by Stenhouse (1975) and Schön (1983) (see Ch. 3.2). The effects of schooling, in general, were also dealt with (Johnstone 1981, Vaherva and Juva 1985).

The data collected consisted of the plans of the groups, some teacher reports, and an inquiry at the end of the spring term. Because the term had been very hectic, as was described above, and it was the end of the academic year, only a little more than half the teachers answered the inquiry. Though it is impossible to say which of the teachers did not answer (the answers were anonymous), it was apparent that those missing were mostly senior secondary teachers.

Problem II.2 has already been dealt with above. Problems II.1 and II.3 are concerned with the question of the suggestions the groups made for in-service education. The details are described in report 2 (Leino 1987b, 30 - 35) and thus only the general outlines are presented here. The two groups of elementary teachers had different goals: one wanted to get more practice in word processing and graphics programs and, in addition, to discuss pedagogical issues involved in using these programs in classroom; the other wanted to become familiar with special programs in elementary teaching for maths, mother tongue teaching, geography or for developing students' memory, problem solving abilities, attention etc.

The secondary-school teachers made a reservation: if only one machine is available for the teacher, then it should only be used for demonstrations, drill-and-practice for slow learners, and as a tool (typewriter, data bank) for the teacher. The plans of the groups were made with the reservation that a computer class would be available.

The teachers of mother tongue preferred to master word-processing programs and their pedagogical uses. Process writing was a major objective: producing small newspapers, writing meeting minutes, applica-

tions etc. Also, data banks were on the list of different topics. The history and social studies teachers favoured database programs of their own field, pedagogical discussions and visits to publishing companies and other schools. Biology and geography teachers had similar subjectspecific preferences.

Teachers of mathematical subjects wanted to become familiar with special programs in their fields and the pedagogical uses of spreadsheet programs and word processing. The in-service education should include practising.

Foreign language teachers thought that computers could help students who have learning difficulties, and it could also be used in small-group activities. They wanted to visit other schools first and become familiar with the language-teaching programs.

Teachers in arts and crafts had very little co-operation within the group and instead, each subject had a special plan of its own. Computer-aided design (CAD) seemed to be promising in the fine arts, textiles and crafts. The craft teacher was especially interested in electronics and radio-telegraphy, and formed a circle of students for this purpose; the computer was a magnificent tool for him.

As could be seen, the groups had rather subjectspecific plans, except for the elementary teachers. To buy subjectspecific teaching programs was out of the limits of the financial possibilities of the community, and also against the idea of dynamic knowledge, active learning, and knowledge-inquiry skills of the project goals (see Ch. 1). As to the teaching methods of in-service education, practical work was still favoured by most of the teachers, but lectures and visits were also regarded as valuable.

Problem II.4, what the teachers think of school development in general, the kinds of visions they have, was revealing. The elementary

teachers considered the question from the viewpoint of student development, on the one hand, and from the viewpoint of the school and teaching providing answers to the demands of society, on the other. Students had become more active, courageous and behaving freely, not willing to listen to long speeches. This may appear to be restlessness and undisciplined behaviour. A student has to learn to trust him- or herself, develop creativity and problem-solving skills. The learning environment should be peaceful, individually supportive, and freer than before. Small-group activities should be favoured. A teacher should accept new things, keep developing him- or herself, inquire into knowledge about new vocations and new methods, and endure stress. The school is a place which leads the way for the rest of society, with its improved climate forming a good learning environment, and for which parents show their trust. The expectations for the future were very positive. Only a few teachers considered the school to be a place for competing ideologies, a mixture of different demands, and a place where individuality has less and less space because of masseducation, and where non-gifted students' needs are neglected. The computer was regarded as positive, even "the best tool in ages" which "I want to use as much as possible".

The secondary teachers did not consider the situation and future of the school as positively as the elementary teachers. Though the need for individual support was often realised, the possibilities and means were thought to be insufficient, even worse than earlier. The teacher is always in a hurry. Heterogeneous grouping makes the progress very slow. The biggest difficulty seemed to be caused by a few students who, according to them, did not belong in a normal classroom. On the other hand, "the present school is a resting place for too many students". Many teachers of modern subjects believed in increasing individuality, small-group activities, and active learning, but a consequence will be a greater variety in

learning results. The foreign language teachers had the most negative opinions about the future of their subjects in the school. Students' knowledge of language is decreasing, and there seemed to be no possibility for differentiation in teaching. "School knowledge is given as ready-made: slow learners believe they have learnt all and fast learners do not take the trouble to study". Mathematics teachers noticed students' fragmentary knowledge and attempts were made to integrate these pieces into a whole. They do not believe that students' school achievements will rise, but instruction may be changed qualitatively in the direction of various activities, co-operative work etc.

We can draw the conclusion that the secondary teachers were worried about the students' deteriorating achievements compared with the results of the earlier generations. The curriculum and textbooks seemed to consist of too much information, and teaching all that seemed to be difficult, even impossible in the present situation. The computer was seen as a motivating aid and suitable for teaching students with learning difficulties. The first experimental year had been very hectic and thought-provoking, even shocking.

6.1.2 Second Year

During the summer of 1987, the elementary school had received an annex where twelve new machines (Macintosh) were placed in a special room or in an empty space outside the classrooms. The library was also renovated. The way the microcomputers were usually used was to send small groups of students to work with the micros while the other students were studying with the teacher, or vice versa. Depending on the task, the student groups sometimes had to go to the library to get additional information. The tool programs (MacWrite, MacPaint), especially, were

used for different purposes (writing a story for the class newspaper, illustrating it with pictures etc.). The junior and the senior high schools had their new computer classes, one for IBM (with 14 machines) and one for Macintosh (with the same number of machines), according to the teachers' wishes. Because of many technical problems, the computer classes in the high schools were not available until the late spring; some of the machines were available earlier.

The main theme of the year was the project-study method, first during in-service education when the teachers were encouraged also to use it in their classrooms. It was assumed that project-study could be an effective method through which teachers' reflectivity and co-operation were emphasised. The initiative came, at least partly, from teachers, and their experiences and subjective theories could be used as a basis for experimenting and learning. The theoretical framework of the report (Leino 1988) was the project method in the teaching-learning process for adults and for school teaching. The problems were as follow:

III.1 How effective did the teachers regard project-study in their in-service education?

III.2 Should the teacher grouping be permanent?

III.3 Would it be better to keep the same consultant / educator for the group for a period of more than one year or to change the consultants from time to time?

III.4 How did the teachers experience computers in their teaching and what kind of problems did they have?

The data was collected by means of a questionnaire at the end of the year. The annual meeting of all participants also gave valuable information about the climate in the school. In addition to these we also had at our disposal the minutes of the teacher groups, reports of the experiments and many of the students' projectworks.

The enthusiasm was very great among the elementary teachers because of the improvements in classrooms and other facilities, new machines, good in-service courses, and opportunities to practise everything new with the students. Almost all teachers had experimented with computers in teaching and had "trials, errors, and aha experiences", as the teachers' report expressed it. "Computers have helped the teacher and the students to meet in a situation different than the traditional (teacher-centred) teaching. The differences between human beings can be better taken into account when each and everyone, however weak in skills, can produce something, unbelievable even for him- or herself. Even a weak child can experience the joy of success."

As benefits of computer use, the elementary teachers regard the children's increased willingness to write and the fact that the children paid more attention than earlier to writing correctly. Early contact with typewriting gave positive experiences. Students' undisciplined behaviour had decreased. The teachers were satisfied with the cognitive and affective (in terms of motivation) learning results. Their new ideas had increased along with the use of computers.

The problems they encountered was the lack of time to practise: students need a lot of time to practice, which means that the number of computers have to be greater than they are, and the teachers need time for the practising and experimenting of "what suits me and what doesn't". "It is better first to have a theme and an idea and after that, it is the machine's turn."

We can draw the conclusion that the project-study method was experienced by the elementary teachers as being very good. They had found it effective in teaching, too, and used it to a great extent. Co-operation had increased between the teachers.

The opinions of the secondary teachers were more heterogenous than

the elementary teachers about the usefulness of computers and the in-service training. In a major meeting (in December 1987), the secondary teachers strongly criticised the way computers had been introduced in the school and how the in-service had been organized. They had had to teach their substitutes and, thus, their working load had doubled. The basic idea of the project study had been stressful and had failed. The objectives had been vague because the teachers had not known what to do with computers. When there was no clear objective to attain or focus the plan on, it was very difficult to plan. The consultants had not always been successful, and the project of the group had not progressed. The skills developed during the first year had not been experienced as sufficient for starting the teaching. The projects of the groups had been experienced as too large and unrealistic to be carried out within the five days (one in-service day had been used for planning).

We can draw the conclusion that the secondary teachers had experienced a lot of problems in finding concrete projects which could be useful and could be carried out within the time available. The group of project leaders noticed that many project suggestions were rather demanding, but they decided that the teachers had to be allowed to fail too. That is a part of becoming reflective practitioners. The lack of computers in the secondary schools was a reality during the fall of 1987. Some groups of teachers had problems getting a good consultant with a good knowledge of their subjects and pedagogy. (By that time, only a small number of subject specialists had specialised in using the computer.) To use tool programs in subject teaching was too new for the teachers who were used to receiving well-structured and subject-based in-service training. "Too grand an attitude for using computers in teaching different subjects bothered all plans". "Nobody had a good vision of the use of computers, the teachers had to find it themselves", was expressed by a subject teacher in the minutes.

Though the meeting seemed to be hectic and the critical opinions openly expressed, it was only one side of the coin. At the end of the meeting, one teacher after another expressed his or her opinion of the necessity of continuing the project and their satisfaction with the project-study. The principals reported that many teachers had experienced new in-service education and computers as rewarding. Their groups had made good progress with the aid of a competent consultant, who had also helped them to make the project plan. For instance, the groups of foreign language teachers and teachers of mathematical subjects were rather optimistic concerning the future. The meeting unanimously agreed to continue the project and project-study as a method of in-service education. Those reluctant were given an opportunity to express their views.

Project-study as a studying method requires a teacher or consultant who can give his or her helping hand when needed. The elementary teachers had managed to have a competent consultant, and so had some subject-teachers' groups. The teachers had not been familiar with the kind of in-service education in which the consultant does not give lectures and does not tell what should be done, but allows the learner to suggest and make errors too. Being a pioneer, as most of the teachers of the project were, is always stressful, particularly when you experience that there is no clear objective in sight, only demands and expectations coming from the environment. The secondary teachers certainly knew the existence of special CAI (English, very few Finnish) programs but the community had no money at the time to buy them (in addition to the computers). The group of project leaders, and the superintendent in particular, had clearly given their preferences concerning the order in which the different programs (tool programs vs. subjectspecific programs) were to be taken into the project. It certainly was one reason for the teachers' discontent.

In the spring of 1988 the groups made their second project plans for

the following year. No problems appeared. At the end of the second experimental year the teachers gave their opinions of the project study, how permanent the groups and the consultant should be, and how computers could be effectively used in their subjects. Only about a half of the teachers answered the inquiry. Now the missing part consisted mostly of the elementary teachers, because the town council had not accepted their project plan for the following year. (The plan included a visit to a Freinet school in France. The group of project leaders had accepted and recommended it, but the town council did not regard as necessary visits of communal civil servants abroad.)

The teachers regarded the idea of project-study as a method of in-service education as good, the elementary teachers even as excellent. Though the secondary teachers had some reservations, these basically concerned the organisation. Among the advantages of the project-study, the following were mentioned: opportunity to concentrate on what is experienced as important or on which skills are insufficient, opportunity to influence the content and timing of in-service education, high motivation and enthusiasm to develop teaching, increase of teachers' co-operation, continuation, opportunity to develop skills too, — and not only standard knowledge — and get support when needed. On the other hand, some teachers remarked that to plan a project study presupposes that teachers become familiar with the issues and the alternatives in advance, and is consequently rather demanding and stressing. As another disadvantage, some teachers mentioned the difficulty to ask the consultant anything meaningful because of the lack of relevant knowledge: "One cannot ask anything if the objective is not clear."

Many elementary teachers were afraid that the rejection of their plan (by the town council) would have a bad influence on the teachers' motivation: "How can we become motivated again?"

As to the question of how permanent the group and the consultant should be, the opinions differed: a well-functioning group or a good consultant is a powerful resource and necessary at least during the first years, but, on the other hand, a teacher should be allowed moving to another group according to his or her interests; and to have a new consultant with new ideas may be refreshing. Within some groups of subject teachers, a need for differentiation on the basis of subject or school level was expressed. The majority of the teachers were content with their consultants.

The last problem, III.4, concerning the use of computers in the classroom and what kind of obstacles had arisen, gave new information. The answers showed that the teachers' opinions of the former aspect had radically changed from their expectation before the project started, but the latter aspect of obstacles remained quite the same as the expectations. According to the elementary teachers' opinions, tool programs were the most useful in teaching, though LOGO and problem-solving programs had also proved to be useful in the evening circles of voluntary students. The subject teachers' opinions varied from one subject to another.

The teachers of modern subjects regarded "tool programs only as a basis" (i.e. word processing and database programs), but specific programs were also necessary and useful in teaching. Teachers of foreign languages regarded word-processing program as useful, but again special programs for foreign language learning and telecommunication contacts abroad were also necessary. Teachers of mathematical subjects said that computers are useful in teaching geometry and statistics, as measuring equipment in physics, and databases in natural sciences. They can also be used in complementary teaching and for drill-and-practice. Tool programs were not of special importance in mathematical subjects; the expectations

were directed toward special programs of the subjects. Teachers of arts and crafts regarded design programs with colours as the most promising.

With the exception of two teachers, all the others regarded computers as potentially useful in teaching, but "increasing student-centred work is the key question for instructional development". "Project- study works well in teachers' in-service education. It gives you internal motivation. It works as a cognitive learning task for the teachers, an excellent example of the study which we very seldom experienced when we went to school". These two quotation from the teachers' reports were evidence, already at the end of the second year, of a good internalisation of the goals of the project.

6.1.3 Third Year

The third year can be called a year of active development. Now the school-based in-service was familiar and the project method too. The schools had computers, and project plans now included much pedagogical discussion. The remodelling of the elementary school had been finished and it had started in the secondary schools. The use of computer in telecommunication was introduced as a new technical objective in the project and the teachers were encouraged to experiment with that too. More and more teachers experimented with teaching within the framework of projects. Organising projects is much easier in elementary school, where all subjects are taught by one teacher, than in secondary school where a schedule of different teachers is fixed. Thus, project study started in the elementary school. The secondary teachers also thought it good because the students had already learnt the method before entering the secondary level. That is the main reason why the report of the third year concentrates on the elementary school.

During the two first years of the project the elementary teachers had learnt to use computer as a technical equipment and as a pedagogical tool in the classroom. Their focus had turned on the development of instruction. The project-study method had offered them a means of holding planning meetings during the working day: while the students worked in small groups on the project, the teachers of the same grade-level co-operatively planned the next project. They had organised three grade-level groups, so called "cells" of six teachers: the cells of the teachers of grades 1 - 2, 3 - 4, and 5 - 6. Each cell elected a chair. Thus, the teachers' co-operation and professional development had an organisational basis and stability.

The development of the teaching practise followed a pattern: first some teachers agreed on a new idea and then they implemented it in their classrooms. We call them pilot projects. These pilot projects were discussed in teachers' meetings: how they had worked, what kind of preliminary work they required, how to organize them in practise, and what the experiences and results were. Because each teacher had his or her own subject-based or other interests, the projects became quite different.

It is always very difficult to measure the development of the teachers' professional reflectivity because it can appear in many ways. The data for the report (Leino et al. 1989) was collected by asking some of those teachers, who had actively searched for new forms of active learning, to write short papers of their experiences and feelings. We promised to publish them in the annual report if possible. The superintendent was also asked to write a paper from the viewpoint of school administration. We had opportunities to observe the actual teaching: whenever we visited the school, almost always some teacher asked us to come and look at the students' work in his or her classroom and to discuss it. We received copies of students project work, saw students' dramatic

plays, exhibitions, dancing, and gymnastics, listened to musical performances, etc. No immediate and systematic record was kept but later on we wrote down our experiences. However, the main data used in the report consisted of the teachers' papers and the students' worksheets. The papers and everything we saw confirmed our view that the staff could be characterized as being highly enthusiastic, developmental, and creative. The project was on its way to progress and success in this school.

The problems of the report dealt with school development:

IV.1 How did the project study suit the development of teaching? and

IV.2 What kind of administrative decisions have been made to support school development?

The first problem is a natural continuation of the project: the teachers had practised the project-study method in their own in-service education and experienced it as an active learning process. They were also encouraged to use it in the classroom and they had done it. The second problem concerns the issue of how the school administration can give support to the developmental process. (One additional problem, of how the effectiveness of a small group depends on the individual members' knowledge accessing modes, was also dealt with, but these results are not included in the present report.)

The theoretical framework of the report was made up of the components of knowledge, personality, and co-operation. A comprehensive approach to the concept of knowledge and knowledge accessing modes was adopted. Knowledge interests by Habermas led to hierarchical approaches: the core is technical and rational, expanding to hermeneutic, and finally to the emancipatory aspect (see Sarvimäki 1988). Starting with an individual, how he or she knows something and how he becomes convinced of what is trustworthy, three general knowledge accessing modes were emphasized: rational, empirical, and metaphoric (or noethic) (Royce and

Powell 1983, Rancourt 1986, Leino 1987c). Personality was dealt with according to Sullivan's (1984) theory. The intentionality of the human being was emphasised. However, intentions are coordinated, open, and connected with taking responsibility for the consequences of an act. Learning is basically regarded as a social process: the topics are chosen from the esteemed cultural heritage, and the steering process in school is social. Of course, learning is a psychological process too, but in school we cannot see it only as a process of an individual learner. Co-operation was related to the two components: teaching, especially when the method of project study of small groups is used, and the teachers' developmental activities.

The four teachers who wrote the papers (to be published) represented the staff rather well: a young (< 30 year, male) teacher (A) who had taken his Master degree in educational sciences (according to the new 4.5 - 5 year programme of teacher education in university), a married couple (< 50 year) (B and C), and an experienced (< 60 year, female) teacher (D). Each of them brought his or her personal interpretation of the demands, personal developmental history as a teacher, and new instructional ideas and attempts.

Teacher A considered the teaching profession to be complex, pressed by conflicting values and expectations from outside, but the greatest demands are made by him- or herself in daily teaching. "The teacher knows that the expectations of school mostly depend on the capability of the teacher... In order to develop, the teacher has to reflect on his own acts in the classroom and among his colleagues. Willingness to develop oneself depends on to what extent one thinks one is able to influence one's own work. Willingness to develop oneself is the starting point of school development." He considered teachers' interpretation of curriculum as a crucial issue. Teachers' co-operation to carry out a new idea or project

made them commit themselves to the attempt and to make decisions. The goal of the project, to develop the school through the Inside-out strategy, "...has created good spirit and activated the teachers to think collaboratively of improvements". The cooperation between parallel classrooms had been the most successful: opportunities for joint projects, integration of contents, planning together, students' joint performances, joint excursions, exchange of materials, and team-teaching. Project-study was experienced by the teachers as a good method for revealing problems in the students' works and for helping to reflect on the guidance and support the individual students needed. "A teacher's help is not good enough for capable students; they want to clarify things themselves. Then he has more time for those students who need it most." In-service education was experienced as effective when the teachers elected one at a time among themselves to introduce to the others a new idea or theme and discussed it thereafter. "The teachers become used to co-operation."

Teachers B and C had a long tradition of working together. They had not only discussed problems together, but had also taught the students of each other's classes whenever needed. They had also rationalised their work: "You teach history in my classroom from 10 - 11 and I teach civics in your classroom at the same time". They worked like a mother and father for their students. The husband (B) had been very interested in photography, using a video camera, and doing editorial work. New technology has electronized these fields and all this can be made use of in teaching too. Working with students in a project in which "school news" was edited, or a celebration, play, or special performance had to be videod, were his new ideas. On the other hand, the spouse C supported B and took care of more traditional teaching (mathematics, history etc.) or new projects about the geography of Africa etc. Teachers B and C were among the initiating members of the project "Builders of the future", and their contribution in

the official exhibition was crucial. The project took more than a year to plan and implement e.g. at a school camp and exhibition. "Each child will be able to develop his or her personal talents to become a 'journalist-scientist-artist-neighbour-doer-technical achiever'." They produced a video, to be presented at an international congress (Oxford, U.K.), with success. Teachers B and C preferred doing to speaking.

Teacher D started her paper as follows: "I ask myself every day why we are here, my students and I. I do not rely on anybody who is too certain of the truth concerning school. I think that running a school is an eternal search for new truths.... When we, my students and I, start (a new project) we are not sure where we are going, but in my opinion, we have to have fun. I feel I am at the beginning all the time." She thought that working to solve a certain problem in smallgroups was the most meaningful method for students. "Smallgroup work and project study are not today's inventions... Students sit permanently in smallgroups in my classroom and do their independent work by discussing and helping each other. Sometimes they do the same tasks, sometimes separate and individual tasks. A relaxed feeling creates a good climate for learning." She liked to organise a drama, particular in history, religion, mother tongue and foreign language teaching. "We use the textbook as a starting point. The students read the whole chapter and then choose an interesting topic to make a report or play. Reference books are used too." "I am convinced that we have not even approached the limits of learning." Electronic musical instruments, TV, videocameras, and computers were frequently used. "No better has ever occurred during my whole career than bringing computers to the classroom. The computer as a tool influenced my teaching crucially. Working with computers has been experienced almost as a prize, though students are doing their grammar tasks. My role has changed from a questioner to an answerer. A student learns ideally when the problem has

become real for him (or her). He (or she) receives information when he (or she) needs it. If the teacher does not know, we try together to search for it through discussions or from encyclopedias or other information sources". The students edited their own newspaper with stories, dramas, poems etc. "Now they write to each other, they have an audience.... The amount of writing has increased and mistakes decreased through practice, as they write a lot. On the screen they easily notice their mistakes, and correcting them is not felt as tough."

We can draw the conclusion from these papers that at least these teachers had internalized the goals of the project, and were very satisfied with it. Modern technology was easily integrated with practise, and it had helped them to prefer active learning to traditional teacher-talk. Teachers' co-operation was a natural and efficient way to develop instruction.

The superintendent considered "...it necessary to develop school in a way demanded by our modern society. ... The decision about the project in 1985 for 1986 - 1991 was under those conditions broadminded. The new and progressive school legislation had been affirmed only a year earlier. The goals of the project presented a totally new way of running a school. Teaching had to be individual and student-centred, the conception of knowledge and the sources of information had to be changed according to modern society, the role of the teacher had to be changed from a performing artist to a planner and supervisor, the student had to be activated to become an independent and goal-oriented actor." The group of project leaders consisted of representatives of all levels of the school administration and representatives of research. The idea was to have a supporting structure for the project: the project would go on without any bureaucratic delay and the possible results could be made useful in other institutes of the educational system. The involvement of the local school

administration was very important: political and financial resistance had been kept to a minimum. Within the schools, the organisation of the teachers' groups made collaboration possible. The groups were formed in a way to facilitate communication. The duties of the group were planning, implementation, and evaluation of what was done. The groups had to specify objectives and make a work plan, including the contents for each year. The work plan was divided into periods which would help to attain the objectives and to evaluate if the objectives have been attained.

"At the beginning of the project it was assumed that computers could be brought into the school in three stages:

- to teach information technology in the junior and senior high school and in evening circles of the elementary school, to be followed by
- computer-based instruction, and
- computer assisted instruction.

Getting the computers was planned accordingly. It was typical of the process that everything was looked at from the viewpoint of the teacher and the subject." Soon it appeared that the plan had to be changed.

The beginning of teachers' in-service education was very tough, too. Firstly, the negotiations with the teachers' union lasted three months, without decision. Then, the question of who will ask the substitutes if the teachers study during their working hours was difficult. "At last an agreement was made, with participation declared voluntary."

The follow-up of the project also had to be arranged. Several meetings were held: for the teachers' groups, for the teachers and the consultants, for all participants, and, of course, for the group of project leaders. In addition, the School Boards had their meetings in which the basic ideas of the project and the objectives of each year were introduced and discussed.

The supportive infrastructure of the project was kept flexible and,

hence, it was modified slightly. The cost of the project was reasonable: about 1 % of the available funds of the education budget was reserved for the project. If school is regarded as a developing institute, like any other public institute or private enterprise, then 1 % is a minimum. Publishing the annual reports was paid by the Department of Education of the University of Helsinki. The superintendent was satisfied with the progress of the project. "A delay occurred in changing the teachers' attitudes. One of the reasons for this was the conditions: the buildings were old and there was a lack of machines in the beginning, when people were asking if the direction of the development was right. Now all seem to agree that the direction is right. The people in the immediate environment have been unanimous concerning the development, and have supported the project."

The school and administrative organization was developed systematically, according to the concurrent demands. As could be seen, the role of the principals during the first three years was not mentioned in the paper of the superintendent. However, the principal of the elementary school had the important role to motivate all the elementary teachers to stay on in the project. In the junior and senior secondary school the old principals had to leave their jobs, one retired and the other followed her husband abroad for several years. Hence, the secondary school principals had an influential role in the project after the third year.

6.1.4 Fourth Year

The in-service education of the fourth year followed the previous pattern: the teachers had made the plans for in-service education and these plans were implemented in the groups. More and more decision-making power was delegated to the groups, not only of the objectives, contents, and organization of the annual in-service education, but also of the direction,

timing, and financial responsibility of the instructional development in their fields. In short, the teachers were steered to accountability on the school development in their fields. The teachers were strongly encouraged to use the project-study method, also in the junior and senior secondary school. The positive feedback from the elementary school was the main argument.

The major meeting of all participants (in December 1989) was very positive and constructive. The teachers' groups presented their activities, problems which they had observed, and future goals. The superintendent dealt with the financial issues, and the researcher the previous report, as well as the theoretical aspects of the continuation. The group of project leaders had been remodelled, consisting now representatives of all groups, the principals, the superintendent (as chair) and the researcher. Each school had a supervisory team consisting of the representatives of the teachers' groups, the principal, and the vice principal. The connections to the interest groups outside the school, kept on though the co-operation, was now less intensive than earlier.

The problems of the annual report (Leino 1990) of the project focussed on the use of the project-study method in the secondary schools:

V.1 What kind of projects, in which subjects and levels, and how effective they were?

V.2 What kind of objectives had been set?

V.3 What was the teacher's or teachers' role in planning, in elaborating of the theme or topic, during the working, in summarising, and in feedbacking?

V.4. What was the role of the students in planning, in choosing of specifying the topic, during the working, and in the reporting and presenting the results?

V.5 What were the experiences of the project study on different levels?

The theoretic framework of the study was made up of a teacher's knowledge and thinking as Shulman (1986) and Schön (1983), in particular, have presented it. The knowledge teachers appreciate has been studied by e.g. Huberman (1985). On the top of the list are knowledge about (1) new teaching methods, (2) student counselling, (3) selection of the method, and (4) new information and skills in the field. However, the criteria of the new information are functional: teachers implicitly reflect on the workability of their own work, ask their colleagues' experiences, and finally experiment themselves it. Now the subjective theories and teaching styles come into view. The main criterion of the success of the experiment is students' participation, i.e. a process criterion. Of course, other criteria are also used, such as the results in the long run, planning and organizing work needed etc. The problems in the experimentation of an new idea depend on many factors, such as the conditions and materials available, teachers former experiences, pre-service education etc. The conceptions differ depending on the expertise of the teacher. The expert teacher has more comprehensive concepts of the different facets of teaching than the novice one (e.g. Berliner 1986, Ropo 1987). It has been assumed that a special school-development project could further teachers' reflectivity and, hence, becoming experts (Stenhouse 1975, Lieberman 1988, Ingvarson 1990).

The data of the study was collected through an inquiry at the end of spring term, 1990. The instruction of the inquiry steered the teachers to answer about rather small (2 - 6 lessons or the like) projects. Most of the big projects (of several months), which had been organized in the school, were not among those reported. The total number of "small projects" was 18. It is probable that they form a representative sample of typical activities in the school within the concern of the study. The practical

subjects in which teaching occurs mostly in projects are not included.

Most the projects had been organized in one subject, but several of them integrated two or even more subjects, such as English with geography, biology with geography, natural sciences with history and mother tongue, and several art subjects with mother-tongue teaching and mathematics (a big project about the Winter War of Finland). A theme of foreign languages took a week and included all foreign languages in the school. Because of the differences between the projects it is not meaningful to compare the numbers of the projects in different subjects. The project-study method had been experimented with almost in all modern subjects.

The number of lessons used in one project varied to a large extent. About a half of the projects were small, 3 to 7 lessons, and the half bigger, 10 - 20 lessons, with one exception of lasting several months. The size of the groups of students varied too. In the junior secondary school the size of a group was about 12 to 20 and most of the projects had been implemented there, but in the senior secondary school the size was quite large, even 35 to 37 and still projects were carried out. We draw a conclusion that the project-study method can be applied, even in big groups of students though the planning is then laborious.

The objectives of the projects, were such as:

- becoming familiar with independent work
- independent inquiry and work
- learning by doing
- developing one's creativity
- helping to see the topic from many points-of view
- learning knowledge accessing modes
- learning investigation skills
- motivating learning

- presenting results in a foreign language
- becoming familiar with dramatising
- understanding social decision-making and power

and project study was also suitable for attaining subject-specific objectives, in particular in current topics, such as living conditions in the third world, political movements, etc. The list shows that the teachers expected to attain, through the project-study, such results which are not usual in teacher-centred instruction.

The amount of planning time of a project depended on the project but the average amount was about 6 - 7 hours. In a half of the projects the task were the same for all smallgroups, with additional options, and in the half, the whole topic was divided into partial tasks for the groups. In the latter case, it was necessary to collect the pieces of results into the whole; and for that phase, the computer was used in several projects.

Teachers often were the initiators, though students also participated in the planning in a third of the projects. Teacher's role during the working phase was to give advice or hints, and to steer and follow the process. If the project was an excursion, the teacher was as a student among the other. Teacher's crucial role was in the summarizing phase, when the results were collected into a whole and encouraging or evaluative feedback was given, or when the transferring or expanding discussions were needed. Many teachers regarded the normal student assessment as unnecessary, even harmful in this connection.

The role of students seemed typically to limit to choosing the task in the list made by teacher. Students had planned the project from the very beginning in only one third of the projects; in a few projects they had an independent role within the topic. In some projects, lots were drawn of the tasks. Small groups of two or 3 to 5 students formed the most typical way of organization. How the groups were composed did not seem to be

very important for teachers. The only exception mentioned concerned with foreign language teaching where one of the couple had very good knowledge of the language and the other poor. The procedure turned out to be successful after the problematic beginning. The results are in a good agreement with the expectation that in the beginning the content is the most important aspect for the subject teacher; the importance of pedagogical knowledge comes later (see Shulman 1986).

Teachers' experiences of project-study were surprisingly positive: students were very interested and worked intensively. According to the teachers as a result the improved "learning climate" and "social spirit" were achieved, and a new aid for a "differentiation of teaching" was found. "Students' independence" and "abilities for co-operative learning" were increased, "creativity was given a chance", "imaginative forces were used more than earlier", "motivation", "socialisation" and "inquiry skills" were improved, as well as students' "perseverance in studying", and "performance abilities". These were the teachers' positive comments. The problems related to the project method focussed on the teaching conditions, lack of materials, difficulties in organisation, excursions, lack of money, and lack of laboratories for science teaching. Only two teachers mentioned the problem of the students who tried to "fly on the wings of others" or who did not want to do the job. The great number of students in the senior secondary grades caused labourous planning, as did the obvious lack of computer literacy of some students and the simultaneous help demands of many small groups in the beginning of a project were the disadvantages mentioned. However, the advantages were much more numerous than the disadvantages. In the fourth experimental year the high-school teachers seemed to adopt the project-study as a method of specific educational value.

6.1.5 Fifth Year

The fifth year continued in the way than the year before. The groups made their plans according to the demands they regarded as necessary (on the basis of their own experiences and negotiations with the other) to enter on the following step of the school development, the group of project leaders accepted the plans, the groups organised the in-service education including didactical discussion to a larger extent than earlier, and the teachers made attempt to transfer the skills and knowledge into the practise.

In the beginning of the fifth year, the project was introduced at an international congress (IMTEC) by the superintendent and the representatives of the teachers. Teachers' autonomy and responsibility for the instructional development increased. The elementary teachers began to plan a new curriculum in which students' knowledge, skills, values and attitudes were emphasised more than topics/contents in the traditional curriculum. Preparing the secondary school buildings they had attained the second stage in which e.g. the language teaching had their modern classrooms. The idea was to place multi-activity spots into the classrooms: on one wall there were audio-recorders and computers, in the centre was a table for discourses, and there were also some desks for individual work. All computers were connected in the same network. The classroom made it easy or even obliged the teacher to organise teaching on the basis of smallgroup activities and, thus, very differently compared with teacher-centred teaching.

No special data were collected about the results of the fifth experimental year, but instead the data concerned the whole period of the project. Thus, it is better to include the description of the fifth year to the whole experiment. A general opinion of the school development was

rather encouraging: the principals and the teachers had accepted the continual change not only as a reality but as a necessity. The school seemed to have reached a state of stable development.

6.2 Project as a Whole

"The whole is more than the sum of its parts". This motto of system theory may also describe the project. The detailed descriptions prevent one to see the total change. Teachers who experienced the whole process are probably not the most objective persons to tell what happened throughout the years and why. However, they have lived through the changes, problems, and sometimes the rewarding happenings. At the end of the 5-year project, the teachers' groups were asked to write down their main experiences concerning what important had happened, what can be recommend to others, what could have been done in another way, how the future appears, what position the modern technology had attained, and how project-study or other new methods seem to be applied in teaching.

The other data come from interviews with the superintendent and the three principals. The themes were the same as above, but the interviews were quite informal and relaxed: those interviewed told how they had seen the changes and if some aspect was missing the interviewer took it fourth. The principals had seen the process within the schools and the superintendent from outside. They were participants of the project, but their viewpoints were different. The researcher must interpret the data and offer the "truth", though he too was one of the actors in the action research.

6.2.1 Superintendent's and Principals' viewpoints

School council

The superintendent saw the development in many sectors. Decision-making "...in our community has changed strongly. Compared with our neighbouring communities they have a school administration in which the School Council takes care of the smallest details, and they have established a special planner for each group of matters. In our system, my job is to be a coordinator and sometimes an initiator, and all matters are co-operatively dealt with the teachers. I called this a model of "action level"; the teachers make decisions for themselves, but in the neighbouring communities the Council makes decisions for them, they have a "top-down" model. In our schools all the development are made by the teachers, e.g. developing the elementary school curriculum, none but them is involved; I only follow it and see them working. I regard this administrative model as quite productive. Today it is not necessary for me to deal with small matters at all. The possibilities and necessity, too, to delegate decision-making are considerable today. And the trend is clear: the teachers want to be still more independent. If it is good or bad the supervisory teams are now rather independent; by bad I mean that the groups (in the different schools) should also work together."

Educational governance in the community of the project had changed from the administrative model to the professional model (see Stürman 1990). The professional model takes regional and central offices as facilitators and the School Council as advisory and supportive, uninvolved in any "professional" issues. Schools are responsible to the community and the parliamentary system at large, but no normal methods of evaluation would be used.

"The school developments have been different on different levels. The

elementary school has developed quite linearly, and the direction has been steeply upward. Even the last teacher is now among the other developers. The top has went far ahead. They have adopted a tactics of pilot projects: some teachers experiment a new idea and then all teachers discuss it. In the junior secondary school the teachers' groups had different bveginings. The resistance was quite considerable and my first job was to break it down. The second duty was to motivate the teachers' groups to systematically development teaching in their fields. The development was quite slow for two years, but then a rapid change accured in the third year and the development has been fast and linear ever since." In the senior secondary school "...the biggest brake in the run of development has been the matriculation exam. The teachers think that all the time, which is insufficient, is needed to teach the subject matter to garantee the good results of students' in the exam. No time is available, so they tell me, for doing any other way. In that bustle and bustle there is no time to ask and think if the present way is the best or if another even more effective way exists to act." Traditionally the exam results had been very good in the school, and the teachers were proud of the fact. It is understandable that any change in the "status quo" seemed to be disturbing.

When asked the reason for the slow start in the secondary school the superintendent smiled and said: "It is a funny system of these subject teachers, their first fear is the status of their subject. When an integrated project is discussed, the first question is how many lessons is my subject going to have; then comes the question of the extra payment, at least as hidden. Then half a year is spent during which potential effects of the project on their subjects are considered, with the teachers wondering if they dare to begin it at all." "Forming the teachers' groups was a special problem: Which subject fields can belong to the same group than my subject? And when the groups were formed, then a common basis for the

work of the group was difficult to find." "It was much easier to find a resisting agreement. I don't know what this tradition is, but I say that if any developmental suggestion penetrates the subject teachers, it must be good indeed!"

"The last two years have been very good in our school development. But not until the junior and the senior teachers had their own groups. Now these separated groups have inevitably been regarded valuable; as long as they were together, the value and spirit were missing." "The project has also made in-service education valuable: "Without it you'll soon become a B-class teacher." Though participation was considered necessary, for a long time in-service education was separated from the development. The education of the last two years have really focussed on changing the work. Each group has ranked the top five objectives and planned the in-service education accordingly."

When asked if another strategy could have been faster, the superintendent replied: "The main agent for learning is motivation; and rising this kind of desire is most important. A strong leadership system with controls and sanctions could have brought new water into the well, but I doubt if it would have remained there."

The superintendent regarded the annual reports as a very good introduction to the matter: "When you have experienced all that you know, and remember something, you don't know or remember anything else. Then the reports have offered a good and comprehensive description of all that. I think that all teachers have read them; they have had a special meaning for the supervisory teams. I have received a lot of feedback on them, even very suprising details. Teachers' conceptions are emotional, too."

For those in other communities who are interested in carrying out a similar project, the superintendent offered the advice that the principals should partake in a special meeting in advance, and make the main ideas

and visions of the project very clear. Principals form a powerful chain in school development. "In our project the principals' role has become very essential during the last two years."

The future seemed to be promising: "We have now had a good beginning. When the ship turns its course, as it has now, then it really moves. The goals are now clear for everybody and the supervisory teams work very well. ... The project has caused the present state of continual change, i.e. the structure of change has been created. The best teachers are clearly searching for new ideas and pilot projects. The groups have to decide to develop them."

Elementary School

"The development during the 5 years of the project has been enormous. I have found the climate and functioning now totally different from the beginning. Teaching and running the school have become free, to a large extent. I think we have been freed of old routines and instead, have bravely taken new teaching methods into use. It has motivated the whole staff and the capabilities, hidden in the old system, have now come out. ... The students have experienced school as a convenient place to study in. I have noticed no cause for school anxiety during these years. On the contrary, students have stayed afternoons in school to complete their unfinished work, and even have contacted the evening caretaker to arrange it. In the students' work I have found new expressions. ... The contacts between the school and the environment have strongly increased. Students' studying has oriented more than before to practical issues supporting everyday behaviour. All this has made students very courageous, independent, and critical in their own ways. They have not uncritically adopted all that the textbook offers, but wanted to know more about the topic in question."

The quotation above describes well the general attitudes and experi-

ences of the elementary school principal. He had been the principal during the entire project, and tried to keep his staff as uniform as possible on the same line of progress. The project seemed to have emancipated teachers from routines to creative work. The old tradition in elementary teaching included similar creative features, but then the development of modern textbooks suppressed it. The project has enabled these hidden capabilities to appear again, but for other reasons, most of which we have discussed in the first chapters of the present report.

The speed of the development was experienced as fast, even too fast. "The fourth year was a "mad year" for the project." Too many separate projects, some of which were oriented out of the school, were experienced "as a mental sickness". "Now the hottest phase is past. The way we tried to overcome the individual explosions was discussion. We have listed the plus and minus effects. The former list was much longer than the latter, but we gave a special treatment to the top five items of the latter list." The biggest problem has been the fact that when most of the teachers had a week of in-service education, the substitutes were not able to do the work of the teachers. Another problem were the many visits which disturbed the normal life in school. "For each visit we have now appointed a responsible teacher, together with the principal and vice-principal, to take care of the visiting group. Not every teacher likes the visits, some have experienced them as disturbing. We could not have imagined that we would have been so popular."

Absenteeism among the teachers increased to a certain extent. "This was caused first by these in-service education courses, secondly the teachers' other educational courses, thirdly by the invitations to tell what is happening in the school, and finally normal leaves of absence and sicknesses."

When asked of how many of the students who finished elementary

school were able to use computers, the principal answered: " Over 90 percent, some of whom are even able to teach teachers. In all grades, the process writing (with the computer) is used in mother-tongue teaching. ... Only some slow student may not make sense of it, but these are very, very rare."

When asked if the secondary teachers complain that the students do not learn traditional knowledge and skills in different subjects because of the integrated teaching, the principal answered: "In this respect there some pressures exist from the community. I personally belong to those who demand that the cognitive area has to be promoted simultaneously. We believe that the child becomes mature in his or her own pace, and learns e.g. to read or write when matured is reached. Teachers are not worried. I want to find a compromise between the old and new demands. We still have the old-fashioned matriculation exam which has not followed the development which has occurred in our school."

"The development in our school started in a typically Finnish way, rather peacefully. We questioned many things, and the beginning seemed to be difficult. It was a good decision that teachers could voluntarily move in to this new teaching, whether or not they wanted to participate in the whole project. That changed the attitudes, and every teacher began to critically think about his or her way of working and to search for a colleague to work with. No drawbacks have appeared. On the contrary, many experienced pedagogues have participated in the project-study; and with their long experiences of traditional teaching, they have a basis for comparison of how the school should be developed. They have experiential knowledge and they have noticed that this new teaching is very good for students' development. It supports those skills which are needed after ten years. The teachers try over and over again with enthusiasm, to find new solutions to the demands which are continuously changing in the school

world. I see the future development of our school in a hopeful light." "The age of the teacher has not made a difference. Development has become the business of the whole school. We have both young as well as old and experienced teachers who look at the matters without prejudice, and between them we have searched for compromises. I have tried to build a bridge if the opinions have differed radically."

During the project the elementary school increased its specialities such as dancing, communication skills, project-study, applied Freinet pedagogy, experimental sciences (as a participant of the Science School -project), and information technology.

"The supervisory team has smoothed the way for the teachers' co-operation: 5 - 6 teachers were to solve different problems. All matters for the teachers' meeting were prepared in this group. I gave it all difficult matters to be discussed and reflected on, and got very good answers." The principal and the vice-principal then made the final agenda.

When asked if the teachers had read the annual reports, the principal answered: "The reports have been very popular. They have been read from cover to cover and have been anticipated with enthusiasm. The text was not too complex to prevent reading and adopting. The teachers found them very interesting. When a teacher has been asked to present the work in our school, the reports have offered the basic substance. In a critical moment, the reports have been used as a scientific basis."

Junior school (Upper Comprehensive School)

The principal of the junior secondary school started the project as a foreign language teacher, then had an opportunity to visit the U.S. to learn how to use computers in school, and then became a principal in the middle of the project. She saw the positive effects of the project as follows: "Of course, the standard of instructional equipment has risen remarkably. We

now have plenty of computers, and nowadays also programs so that we can use them. However, today I asked the students how they liked computers and many of them told that they had not used them a single time during the whole year. The lack of programs has obviously been a hindrance. Another reason has been the lack of time: teachers have not had time enough to become familiar with the programs. They have had time to use computers, but not time for the programs."

"Another matter is the fact that lessons have created a freer atmosphere. In many classrooms the students' desks are arranged in a new way: students sit in small groups or in a form of a big circle. The old fame of the classroom has disappeared. Students move in school much freer than before; e.g. the 7th graders like to go to the library. The ulterior motive may be the wish to leave the classroom in one way or other." This statement is a good evidence of the development, because the changes of the physical setting of the classroom are strongly associated with the learning experiences of both students and staff (see e.g. Hustler et al. 1986).

"All we have done can be recommended to other schools. The computers seem to inspire some students to work. If studying can be made pleasant in some way or even desired, then all means are acceptable. As to what could have been made in another way, the fact arises that we were always in a hurry: when we had barely learnt something new, another new idea was introduced, even though the previous idea had barely been learnt, or had been learnt only partially. That has stressed teachers. If we would have time now to concentrate on the continuation, it would certainly be positive. To teach students how to use these computers and telecommunication systems requires a lot of time."

"As to the project study, it seems difficult in this community to agree on what it means. The School Council seems to have the conception

that only those projects which develop the school are proper projects. If a project is proper then it receives money. On the other hand, the teachers would like to define a project in a way as follows: "A project starts from the needs of the school, it occurs within the school, it is a functional learning process which requires planning and integrating to a considerable extent. The starting point is a concrete problem, the solution of which has to be presented as the result in a concrete way. The project should give a profound and large understanding of the problem by exceeding and breaking the traditional limits of the school subjects. It may last from a day to several years, and involve some participants or even the whole school. It should be defined in terms of time, and the results should be presented in public." Even the expenses of the additional materials should be budgeted in advance." The principal's interview reveals several intentional misunderstandings and conflicts between her and the superintendent. It also reflects a kind of hidden opposition to the way in which some projects have been regarded (by the superintendent) as developmental and others only as ordinary.

"As to the teachers' groups they have worked very well. All the time we have learnt more and more about how the group plans these issues. When no ready model existed, the progression fumbled. The supervisory team is representative. The directing teachers of the teachers' groups belonged to the supervisory team of the school which plans the schedules and other important issues for the following year. The supervisory team gathered the other teachers into the joint enterprises. Of course, some projects were so large that they integrated several teachers' groups."

"The beginning of the project was difficult, when we had to sit at the computer and were told to make programs." The principal again, and intentionally, presented the course of the project in a slanted way. She could not have understood that tool programs, such as word processing etc.,

could be used in foreign language teaching. The only possible method she accepted was the use of special language programs. "Now that we have (language) programs, all the fuss has disappeared. Now we have become a part of society."

To the question of how many students do know how to use computers, the principal answered: "We have a number of students who can do everything and even more with computers — and a number who cannot or do not want to. At least 60 to 70 percent use them."

"I think that the annual reports have been scanned every now and then, but I doubt if the teachers have severely penetrated into them as they should have done. The cause for that has obviously been the rush. Those teachers who have had to present the project publicly have certainly read them carefully."

"We have started telecommunications with foreign schools, but that has just begun. To set up the contact is technically so complex, that only one or two teachers know how to do it. It will certainly increase and develop."

When asked how the teachers had developed professionally during the project, the principal answered: "Certainly some teachers have made progress. For instance, the biology teacher and history teacher have their own modems to have daily contacts with different data banks, and in order to be able to use them in teaching, and they appreciate it highly. However, in foreign language teaching speaking is most important and machines are therefore left in the background. Probably on the senior secondary level the students have the skills to write papers in foreign languages and to use data banks. As the study of Swedish does not begin until the 7th grade, skills are not sufficient for using the banks." For her the goals of the project and the teachers' professional development still only consisted of using computers.

The principal of the junior secondary school represented a traditional teacher who knew how to teach, and she kept her fixed attitudes up to the end of the project. Though she had noticed many developmental features in her school, and had nothing against technological development, there should have been a clear model to follow. To become a pilot school seemed to be a frightening matter. (It should be remembered that she had missed the most rewarding phase of the project when the cultural change occurred.)

Senior High School (Senior Secondary School)

"I came a little late, in 1987, into the project, but then it was the thing which was spoken about", related the principal of the senior high school. "To begin the work as a principal takes a time, especially concerning the school development. What could it mean? Last fall I wanted to know exactly what kinds of progresses our school had made. I then gathered data of the ways and the frequencies of computer and programs use. The data show how many teachers know and use computers in our school. Last night I was invited to participate in a meeting organised by the teachers. The theme of the meeting was school development. Because of another engagement, I came an hour late, but the discussion was intensive and constructive. In my short speech to the teachers I said that the fact they had held this meeting was in itself good evidence that we want to develop our school, and that we have already obtained something. It started with computers and soon moved to a more general development of teaching methods. The beginning was crushing: "Now we learn to make information technology useful!" We used a lot of energy to it, it absorbed us all and now many of us use it daily. Not everybody could go beyond their limits and they felt that they did not need it very much in their work, but nevertheless it changed us, we were arisen to a something new."

The data that the (junior and senior) high school principals had collected about how the secondary teachers use information technology, showed that less than a quarter of the teachers never used it. About one fifth used it continuously. Almost all teachers (97 %) considered it meaningful to increase the use of information technology in planning, implementation, following up, or recording. More than half the secondary teachers still needed additional knowledge and practice, such as how to use data banks, telecommunication, spreadsheets, and even word-processing programs. We can draw a conclusion that, though the secondary schools have a rather high number of computers, modems, and programs, their use is still concentrated on some 20 to 40 percent of the teachers. Those who have not used information technology in teaching experience their knowledge and skills deficient.

"When the elementary teachers had begun to develop their school, taking long strides, and the superintendent came and told us all about it, and what we, too, could do, then we realized that we, too, had to follow. Now the teachers' attitudes have changed; they are critical of their own work: "How could I change my own work, not only with the aid of computers but also in other ways." This is the best thing that has happened in our school."

The principal had realized the goals of the project and also was able to give evidences of how they appeared in teachers' attitudes and practise. "Last night it was reflected in many ways; in the questions the teachers had themselves asked, and in many comments. The teachers have an internal need to develop themselves and their teaching methods." At least the professional development had begun.

"I have supported this development idea, not as actively as the superintendent demands, but as a kind of filter between the superintendent and the teachers for bringing forth and interpreting the messages. We

are always worried what the superintendent now might suggest. Sometimes I have tried to delay a particular suggestion because it might not be considered possible. In general, the project has been experienced as good and it has kept us active in school work. A new activity has clearly increased. Though the teachers regard it as necessary to maintain a certain amount of teacher-centredness in order to be sure that the basic knowledge and skills are learnt, smallgroup activities and independent responsibility for one's learning have been emphasised."

"Our students have succeeded very well in the matriculation exam. The teachers are afraid of radically changing the methods which have brought good results. "Why should we plan something new, what could it be, what do we need, and how do we plan?" These were the questions in the first years, not until we realized that it is a great benefit to be allowed to plan all that we need. Old in-service education was a requirement which we had to participate in. Now the goal was totally different. ... If we now had to take the old system back again, I'll tell you, it would cause a great fuss! In the beginning we asked: Why do we have to plan our in-service education?, but now we have obtained the opposite. I think this is what the group of project leaders had wanted to happen." [Quite right!] "But it was a difficult phase because we had to think about what already knew and what we still had to learn."

The principal saw that the co-operation between teachers had increased considerably. "Now teachers seek points common to other subjects to be implemented together. That is one of the important results of the project. .. Now the coordination of different subjects is more frequent than before, in particular, among the members of the supervisory team but also informally among. It has also helped the principal's work. Administration has been flexible according to the teachers' independent enterprises. We are learnt people, not tabula rasa's. It all works well

without the principal."

When asked if there have been any new pressures to the principal he answered: "Yes, yes. The work is not done yet. I have felt as if I have been in the middle of new ideas coming from you and Antti (the superintendent), even too many at a time. Sometimes Antti's ideas are UFO-like and the teachers hold their ground. It is easy for me to be in the middle, to look at what might happen. In no way have I prevented any idea; I have made possible what the teachers have wanted to carry by means of scheduling etc. Sometimes it has been very difficult. I have experienced it as my duty to see to it that the experimentation continues. It is not possible to go back to the old practice, after all the new developments and fun we have had during these 5 years. Fortunately, the period has been long enough to prevent teachers from going back any more. If an experiment had been short, then it would be easier to forget it and to continue in the old way. Now the old is not remembered any more, the experimentation is now a new instructional practice, a way to penetrate into the subject matter, often together with some colleagues. That has been a part of the positive development."

"You, as a researcher, have brought these ideas to the teachers but have not told how they have to be implemented. You have trusted on us and on learning; it has been good. And new thoughts have really been generated among these teachers. Lack of time has been the only problem. One of the teachers found that the project method took triple the time needed for the old teacher-centred teaching of a topic. I have asked what the learning results have been. Everybody knows that when you have learnt something by independent inquiry, you remember where and how you learned. Learning is more effective. On the other hand, the small groups learn to carry out the following projects faster than the first ones, and the teacher can easily guide the studying process and use the reports of the small groups.

But the beginning phase was difficult for the teachers."

"One of the results of the project is the fact that now the teachers are willing to participate in other in-service education courses too, and come to tell about what they have learnt and what (s)he is going to do in their own classroom. The in-service has attained a close contact with the practise."

"The substitutes (for the absent teachers) were not a problem in our school; sometimes on the contrary. When one of our previous students has come bacvh to teach, after many years of university studies, the students have been even more interested than with the permanent teacher."

"Using information technology in teaching is just beginning. I expect that videos, TV satellite channels, data banks etc. are now just coming into schools. The teachers feel they do not know all about the new techniques and feel incompetent. Fortunately, the staff has learnt to be open for advice: "If I do not know, I have to ask someone who knows and he can help me." Again the problem is the lack of time for someone who to help the others."

When asked if the annual reports are read, the principal answered: "I am sure that they are read because one can always find out something about oneself. Those who have had to tell about the project have read them again and again to remember and understand all the details."

At the end of the interview, the principal wanted to add one point: "We have discussed the concept of the project study in our school. I even look up the ethymology of the word. In one phase "project" seemed to be a swear word, and we had a meeting concerningt the teaching that can can be included in the domain of the project study. Now we have decided that we continue the teaching we have experimented with, wether or not it belongs to the project study." The comment shows that concept of the project study had caused conflicts and discussions in the secondary

schools. The teachers at least had become familiar with it when the in-service education of the second year was planned, and later in another context, in the third year, when they were encouraged to use it in the classroom. In university, the term project study is used to refer to the research that students are required to carry out in their programme of studies. It is basically individual, quite extensive, and an independent stage of the programme. In our project the term was used in a meaning of a small, goal-oriented task in which the learners had possibilities to choose the approach and work collaboratively in small groups. In the report it was said that a small project in the classroom may consist of 2 - 6 lessons, but larger ones can take a week or even months.

Though the problem of the meaning of the project study seems to be the same in both schools, the descriptions by the junior and senior high-school principals are remarkably different in other respects. We will draw the final conclusions when the reports of the teachers' groups are introduced.

6.2.2 Reports of Teachers' Groups

Elementary school

It is not possible nor necessary to describe in details all new ideas, experiments, integrated and separate projects, in-service courses etc. In the elementary school all teachers were involved in the development and the staff development culminated in several large projects, moving from "teaching" to guiding students' learning, and beginning to renew the curriculum. Process-orientation and integrated wholeness can describe in short the main features of the instructional development. Project study and information technology were the main tools for development. We quote a teacher's report on the matter:

"I started to form integrated periods in the third grade, first as a

small-scale experimentation. When I realized the success, I continued more bravely to renew my teaching on the basis of the official goals. And now in the fifth grade the teaching consists of projects (Kilpatrick, Leino), rising broadly from the curriculum, the students having the opportunity to choose the projects and to become motivated in their study. I have made projects e.g. in biology and geography, by also combining history with them if suitable. We have search for news on TV and in newspapers, in order to have real contacts. Small groups of 2 to 4 students have investigated a topic or theme. Their reports have found a place on large wall posters or we have edited booklets for the whole class. I have had time to observe students' working and to listen to their opinions. ... As a new idea, we started to use the Hypercard program in order to build a program on the old villas in our town. Each pair of students added a card, depicting their object, to the system made by three students."

The teacher had given the students a sequence of 9 steps of how to study a project. It was quite similar to a 10-step model by another teacher in the school. The latter was an active member in a planning group of the National School Board and represented his school and the project too; the group was appointed to make a suggestion of how to use information technology in the elementary school and made a radical suggestion. Both the two models mentioned above follow the well-known design presented in the literature (e.g. Frey 1982).

At the end of the year 1991, the Yearbook of the schools stated: "One of the development and renewal of the past year's objectives has been the curriculum. The purpose is to include the present educational and instructional practice in the curriculum. The work is still unfinished. The integrative teaching and project-work have become more general while the frontal teaching has decreased. The goals of the education can be found through the realization that everybody agrees to emphasize and develop the active and independent work of an individual student... The curriculum defines the basis by educational and instructional methods which also fortify our joint vision. This is extremely important because then none among the staff experiences him- or herself as an outsider in his or her work."

"Finnish school has been individualistic. ... The goal of the new curriculum is to encourage the staff to develop a systematic co-operation in which everybody's specialization would be shared by all the others. Instead of textbooks, the developing curriculum defines what is done in the school."

"We often hear the question: When will this continuous change stop? When will schools be able to work peacefully and free from continuous renewals? When will there be peace in schools to work? The answer is: Never. The changes in school will continue and grow even faster; the curriculum will show the way."

This quotation is the best evidence that the elementary school has accepted the school development, cooperation and active learning as official goals, and the curriculum development has begun. An effective school has a strong interest in and commitment to improving the instructional program, curriculum and educational goals.

Secondary School

In the following, the short reports of the four teachers' groups are introduced and discussed.

The group of general subjects consisted of mother-tongue, history and social sciences, biology, geography, religion and psychology. "In the beginning the grouping was considered very artificial. The teachers doubted if the subjects had anything in common. It seemed especially funny to call the group leader as a directing teacher. How could e.g. a biology teacher act as a directing teacher of mother-tongue teaching! ... However, piece by piece we found a suprising number of common matters. The feed-back meetings were especially rewarding, when the teachers gave their accounts of their different in-service education courses. One noticed how interesting it was to listen to the matters presented from the

viewpoints of different subjects."

"The group began to plan the teaching of the subjects from the viewpoint of integration. Simply by timing the topics of different subjects, it was possible to form clear integrated units. We also discussed the curriculum. Some joint projects could be implemented. The cooperation expanded and became more effective all along. The group considered artificial at the beginning has proven to be surprisingly functional and widened the narrow viewpoint of a single subject. Co-operation between the junior and the senior level has intensified."

"Pressures for changes have increased in the schools. Schools should develop and keep up with the times, and answer the changing demands by renew society. The school always holds a key position, but the teacher now also has a key position: (s)he should solve the most difficult problem of how to carry out the new goals in practice among the young and adolescents. Here (s)he cannot be helped by many theorists. Hence, teachers' co-operation has become invaluable."

"We recommend joint planning, projects and integration. Other communities should reserve money for teachers' in-service education like ours. Computers and electronic communication have stabilized their roles as a part of normal teaching, but simultaneously it has become clear where it is suitable and where it is unnecessary. Students are neither necessary and always interested in computers. A balance have to be found. Project study has been experienced enthusiastic. It will increase its position, but requires a lot of the teacher's time. One of its benefits is integration."

We can draw the conclusion that the teachers of the general subjects had reached most of the goals of the project. Their co-operation had increased, need for integration was understood, information technology had become a natural part of teaching, and active learning was

emphasised; in short, the teachers had grown professionally, and realized their responsibility in the school development.

The foreign language teachers' group, in the beginning, had a neutral attitude toward the project. "The foreign language teachers, used to a routine, experienced the in-service education of information technology as interesting. In-service education during working hours was considered positive. The simultaneous modernization of physical settings raised hopes for a new, better school."

"In addition to the use of computers, teaching was also supposed to be developed to so called the project-study. Attempt should be made to making teaching more student-centred and by using broader topics by integrating themes from several subjects. This phase raised opposition among some teachers. All negative experiences were presented, and many regarded it as best to stick to the old way of teaching. Perhaps it was just at this point that the goals of the project were seriously considered."

"As to in-service education, the development has been interesting. We were offered an opportunity to develop our own work and ourselves which is not very usual in school nowadays. ... The process we committed ourselves to in the beginning, has moved us along whether we wanted to or not. The responsibility for the school development is now ours. To see in-service as a continual process may also help us to tell our students about it."

"Of the concrete results we have obtained, the first thing to be mentioned is the up-to-date process of teaching facilities. The language teachers have taken the responsibility of choosing and placing the new equipment. We had to dare to make decisions, quite usual in ordinary life, but so far quite rare in teachers' work. Another new task was the planning of our own in-service education. At first most of us were not willing to

accept it, it didn't belong to our job. Today we certainly agree that it is our privilege. It is true that many of us experience it as stressing, too, and arranging for substitutes is not always satisfactory."

"As to the project study, we have several opinions; some regard it as unsuitable to foreign-language teaching, and there is very little time for it, but on the other hand, a certain enthusiasm can also be found and in some projects all the language teachers have participated together. Smaller integrated projects, with other subjects, have been arranged both in the junior and senior high school. Computers and audio studios have greatly helped to implement the new teaching method. It simply is not possible to use the new equipment in the old teaching; students have to move from one study place to another in small groups. This presumes that the teacher has the skills to guide the work and that the students, too, adopt new methods of study. Without training, one's own willingness to experiment and to dare to practise the change cannot be accomplished."

"To move the responsibility of learning from teachers to students seemed to be new and problematic in classrooms. .. Creating a community of learners is the goal which, at least, the braviest of us are aiming for."

"Experimenting with new methods has caused the development of the curriculum so as to serve the teachers' and the students' hopes and qualifications. A good working group is very important and valuable for that, and now it seems possible to form the group. Following other teachers' teaching and sharing the experiences are what we now need in a small group. Contacts with other schools and colleagues have increased too. We have voluntarily visited in other schools and have been prepared to relate our experiences to guests. A language camp-school and telematics are now within our reach."

"During the project many of us had to think about our attitudes toward the undertaking, and our work and colleagues. Situations have

sometimes become critical and have made the benefits of the project questionable. But we have learnt a lot about the learning process and attitude changes and have accepted them as natural. The best thing is that we have learnt to approach each other with the problems of our work and social environment. We have attained good experiences from our joint projects and these have provided the power which keeps the renewal alive, have given renewed trust to develop a new and better community of learners."

The report of the foreign language teachers contained many critical viewpoints, but in general it was rather optimistic and positive. The old teaching tradition was firmly rooted in their attitudes, but new equipment and experiments had given new impulses and changed them to a remarkable extent. According to an teacher' report, "one third or even a half of the English teaching of certain classes has been carried out in a student-centred way. The new audio studios and other equipment have made it possible." Co-operation between the teachers has increased, and the need for a new curriculum has come into being.

The teachers' group for mathematical subjects had the best knowledge of and skills in information technology before the project began. However, for some members all this was new. The report tells: "Typical [of the first in-service course] was the fact more information was given than could be adopted. In what followed, the educators and teachers began to agree upon the skills, needs, and goals."

"Recently, the in-service education has been directed from computer centredness toward new fields. We have obtained information about new teaching methods, means of problem-solving, and creativity in teaching mathematical subjects."

"The main goal was the renewal of teaching. In mathematics the

change has been slow. The new way of teaching takes a great deal of time in the practising phase, and the fear of lack of time prevents its use. However, we have used e.g. computer programs as a support in learning and as concrete materials for perceiving solids. In a joint project on the topic the family, the contribution of mathematics consisted of buing home. Different kinds of flats, condominiums, etc. became familar, as well as prices and financing."

"In science teaching the project study has been applied more frequently." Several joint projects in biology and chemistry or physics had been carried out. "Both the students and teachers have regarded the variability of teaching methods as meaningful." In the senior high school a joint project in physics and physical education was organized.

"The in-service education has clearly increased co-operation between the junior and senior schools. However, the real goal, to have the whole age group of students interested in study and convinced of its necessity, has not yet been obtained."

The group participated in the project, however critical though they may have been of it basically, experimented with the project-study method, found it meaningful in certain contexts but time demanding too, and increased co-operation between themselves and with other teachers.

The group teaching practical subjects included music, fine arts, textile handicraft, crafts, home economics, and physical education. Hence, the members of the group experienced that they were a mixed group. "At first the group trained to use tool programs and how to use computers in their own subjects. The group could choose their educator, date, and training methods. The in-service education has been of a high quality and standard and a sufficient amount of time was available. Those who wanted to have a computer, have received it, though good teaching programs are still

lacking."

"The teachers of the group work under quite different teaching conditions, and the subjects are quite different. Hence, in addition to the joint in-service education, each teacher has tried to find a special in-service education for his or her own subject. This has helped to open the doors to see what is happening elsewhere, and to tell about what we know and how we do."

"Fine arts have used computers, photography, videos, and overhead projectors in a very practical way. Computers are used at the phase of finishing the text and when graphic editing is practised. Sometimes the in-service education has been experienced as too hasty. The pace of study should be more concentrated and peaceful. Also, the projects should be coordinated to avoid a stressful project-after-project feeling. It has been a joyful opportunity to be along the spirit of the times. The school has to act in society, but not a hasty way. The period between the planning and implementation has to be sufficiently long."

"In [girls'] physical education, computers have had a small role with the exception of health education. I feel that I have received a kind of human capital which I need as a teacher and educator, and that I have shared the 'spirit of the times'. I have used videos to teach gymnastics, dance, and swimming". The teachers of physical education had participated in many projects with other subjects. The teacher of [boys'] physical education believed that "project types of teaching, planned by students, have good possibilities of succeeding with the adolescents, but for the younger age groups the old traditional teaching is necessary to fortify the basic skills."

We can draw a conclusion that the project had been experienced pleasant and useful by the teachers of practical subjects, though it had not changed teaching very much. Being along the 'spirit of the times' and

school development had been rewarding.

The project-study method had been experienced by the teachers as activating and efficient but time-consuming, too. "[New teaching methods] may require numerous lessons and produce very little useful knowledge and skills from the viewpoint of the matriculation exam", was a comment made by a biology teacher. "You'll bump into organizational problems when you try to integrate different subjects or use computer-assisted teaching. .. The computer classrooms are often reserved and some students may not yet have sufficient skills in using computers. .. Then students seem to be the most conservative group in school. They oppose the alternative teaching methods, especially because these require more work and are more demanding than listening to the teacher. Basically the student is lazy." He had surveyed the teachers' opinions of the different teaching methods. According to the results, the teacher-centred methods gave more surface knowledge and student-centred methods more deep knowledge. As the hindrances in using the student-centred methods, the teachers mentioned the following: 1) teacher-based: willingness, incapacibilities, time, lack of materials and lack of encouragement, 2) system-based: matriculation exam, period system, time schedule, and lack of time, and 3) student-based: laziness, avoiding that which is new, incapacibilities, lack of time, and encouragement.

The data collected by the biology teacher are good evidences of the effects of the project. The instructional development, staff development and curriculum development all show the way to a better future.

7. Conclusions

In this final chapter, we want first to summarise the results of the project in order to give comprehensive answers to the problems of the study, and then evaluate the project as an attempt to change the school work.

7.1 Changes in Schools

The previous chapter gave a detailed description of the many facets of the project. We started by introducing some possibilities of using computers in school. All teachers wanted to become familiar with modern technology and to participate in the annual 6-day in-service education courses. Though the purpose of the courses later on became more general and focused on the teaching methods of active learning, in particular, in project-study and instructional development, still, all teachers voluntarily participated in the project. In terms of participation the project succeeded well.

The "philosophy" of the in-service education courses was changed radically. The purpose was to connect in-service education directly with the different school-development attempts, which were felt necessary, or with improvements of the earlier work of the teachers. Though the group of project leaders had expressed the need for developments and suggested some general development directions, the final concretization was left to the teachers. The teachers discussed and selected the most urgent developmental needs in each school, and planned the in-service courses accordingly. During the project, this new philosophy seemed to become appreciated and to offer a new way to make in-service education useful and meaningful. In this respect, the project succeeded well.

Thinking of and deciding upon school improvements, and planning in-service education, were the ways for teachers to co-operate. The superintendent, giving continually new ideas and suggestions, "shook-up" the teachers, quite often causing resistance, but compelled to discuss and take a stand. All these small details added to teachers' collaborative thinking and planning. It was also important to have teachers work together when larger teaching projects were planned and implemented. If the dominant position of textbooks was to be weakened and teaching to become more independent, then teachers' co-operation could offer good support. An individual teacher does not have the courage to radically change the earlier work, but teachers together may have it. In the elementary school we could find this clearly. At the end of the project all the teachers and principals could say that co-operation between the teachers had greatly increased.

Teachers' attitudes towards school development changed to a large extent. Though some secondary teachers still kept their narrow conception of the purposes of the project — that it was computer-use and nothing else — the great majority had realized the wider purposes and the necessity of school development. As to the use of computers, all the elementary teachers and most of the secondary teachers were able to use them in teaching at the end of the project.

The change process began with enthusiasm, but continued in different ways in different schools. The majority of the elementary teachers adopted the basic ideas of dynamic knowledge and active learning as if they had been waiting for them: "At last we are allowed to be creative again!" Very soon about a half of the teachers attempted to integrate subjects into larger projects and use computers in teaching. The third year was quite "wild" to the extent that the principal had to slow it down and make the process unified. In this way the project helped the

elementary teachers, when their ideas became too diversified, to plan changes in the curriculum. However, this did not prevent the start of several new pilot projects. Many teachers were invited to introduce their projects and the basis of the development in other schools and seminars. Thus, they had to study the basis with care and all this promoted their professional development to a considerable extent. The physical conditions and facilities greatly supported the school development. As the teachers' reports and the interviews of the principal and the superintendent showed, the development process was remarkable and fast.

The process in the junior and senior secondary schools was different. The subject-matters were continuously competing with each other; in all changes the first thought about was the position and tested practice of the subject. After the introduction of computers, the secondary teachers began to think of how to use the new equipment in traditional teaching. For instance, many foreign language teachers demanded computerized language programs which were, at the time, beyond the financial possibilities and against the goals of the project. The development process was slow and took a couple of years before it accelerated. However, the project-study method was experimented with in almost all subjects and at all levels with good results; computer classrooms were occupied all the time but not by all teachers; the idea of the necessity of school development was realized; and teachers' co-operation gradually increased. The new foreign language classrooms and new teaching methods are specially worthy of a special mention.

From the examples mentioned above, we can conclude that the staff development was rather fast and remarkable.

The organization development was also rather effective. The teachers' groups became permanent as did the supervisory team in each school. The decision-making changed from an administrative model to a

professional one. The principals and the superintendent considered the new administrative practice to be much better than the old one.

The curriculum development was notable in the elementary school, but had only at its initial stage in the secondary schools. Traditionally, our country has had a very bureaucratic curriculum system, but the situation is changing. The clear change in thinking could be found in the elementary school, where the teachers developed a new procedure for student assessment and began to renew the curriculum. Many secondary teachers changed their teaching which can be regarded as a first step towards curricular changes.

The action research sought its forms in the project. In the first experimental year only two and a half months were allowed to write the first two reports, and after noticing that they were frequently read within and outside the schools, it was decided to write one each year. A long-term project like this can easily lose its grip without some kind of continuation. The reports provided continuation to the project. It was also a way to apply research results in these schools and influence teachers. Especially the group of project leaders and supervisory teams read the reports with care, and in this way the reports offered a basis for new suggestions. The directing teachers and principals thanked for the "positive pressure". This concerned the reports as well as the introductions in the annual major meetings.

Action research is a flexible though labourious research method. It compels the researcher to be open and adopt a constructive attitude to the practitioners, share with them the problems and successess. What we noticed was the continual reciprocal interaction between theory and practice, researcher and practitioners, teachers and learners. Of course, this is not new, but it is useful every time. The researcher becomes a part of the school work, learner and teacher in the same person. The experience

was very rewarding and helped us to be in good touch with the real work, belief systems, and future hopes.

We had good opportunities to make progress in the community where the residents appreciate good education and are willing to pay for it. The municipal government continuously gave good support in principle, even though all financial resources had to be fought. The School Boards provided us with valuable help. We had a small set-back in that two of the three principals had to leave their jobs during the project. We knew, in advance, that one would retire, but the leave of the absence of the other one was a surprise. If we were start again, we would certainly place the principals in a prominent position from the very beginning. School development should have a good organizational basis. Though several details could have been planned in other way, as members of the group of project leaders, in the end we had a feeling that in general rather few big mistakes had been made. An obvious mistake the haste in which new demands were placed on the teachers. Because of the conditions, the teachers had limited opportunities to practise e.g. computer skills, such as using electronic mail, data banks etc.

7.2 Consideration

If teachers' professionalism is to be emphasized, if one is to help them to become "reflective professionals" who are capable and willing to take responsibility for instructional and widely for school development, then outside-in orders are not the best way to make progress. It is necessary to have the teachers realize that they are the best experts in school development. However, developing the school is a tough and long enterprise in which they need different kinds of support. There is no clear vision to the direction towards which the school should be developed. An outsider

expert can help it by suggesting some directions, but it is at that point the work just begins. Every model has to elaborated taking into account the conditions in an individual community and school.

In the literature a strong principal is often mentioned as a necessary prerequisite for change: the principal maintains discipline, emphasises instruction, and clearly articulates goals. This appears to be too simple an explanation. After a successful development process, it may seem that it was the principal who accomplished it. The principal's role is important because he (or she) is the transmitter of the philosophy that drives the system, and also the implementer of goals and conveyer of expectations that make educational improvements happen (Mauriel 1989, 233). The philosophy usually comes from the surrounding system, often conveyed by the superintendent. A school is a social organization too, and there is a conflict between bureaucratic and professional patterns (see e.g. Hoy and Miskel 1987, 144 - 174).

In the school system of the experimental community, the superintendent's role was central during the project. Like Mauriel (1989, 234) stated it in another context."... [T]he superintendent fills an instructional role on several levels. [He] is a teacher of teachers ..., of principals ..., and of the board and the community in any district... If instruction is to be viewed as important and valued by the system, the informed judgement of reflective practitioners and intuitive logic tell us that the superintendent must spend some time in educating h[is] constituent groups on the central role of instruction and also spend some time in schools and classrooms if only for the latter's symbolic value." This all was happening in the community of the project.

Every school development has to be fitted to the persons, traditions, and conditions of an individual school and community. The project we carried out can be regarded as successful, but the success is the result of

many factors. If somebody says that the project was successful because the community was wealthy enough, he or she knows very little about the problems of school development. There are numerous factors which can cause a failure independent of the wealth of a community. It is impossible to extract any single factor or factors which could reliably explain the results. A good organization of a development project is probably necessary, as well as a suitable sequencing of what is done and selection of key persons in the school, a clear vision of better work, support structure, and enthusiastic leaders. These are the main components of a development project.

The process and results of the study can be considered as internally reliable and valid because the data have been gathered from many different information sources, i.e. any researcher could confirm the main results. Of course, we have to admit that even the basic concept of a project-method took on a deeper meaning throughout the experimental years and, hence, was not stable. But this is what can be expected from a long project. However, the external reliability and validity are still much more problematic. It is very difficult to have any evidence of replicability or generalizability of the methods and procedures used in the project. Researcher-status position, informant choices, as well as social situations and conditions (LeComte and Goetz 1982, 37) are basically unique in an action research. Analytic constructs and premises, and methods of data collection and analysis are more comparable and generalizable.

In our country, there are very few empirical studies about school developments and hardly any comparable to our project. Kurtakko (1988, 1990) made a study of computer-use and project-method in four elementary and two junior schools; the conditions differed very much from our project. Kalaoja (e.g.1990) made a study of developments in small rural schools, but again the agents and basic ideas were very different. Heinonen

(1988) and Konttinen et al. (1986) investigated-computer assisted instruction in junior schools and instructional uses of tool programs (word-processing, database management, spreadsheet, drawing, music composition and telecommunication). The designs were more specific than in our study. Hämäläinen (1982, 1983) investigated school-based in-service education and teachers' needs in this respect. Kohonen and Lehtovaara (1990) led a project in which experiential and co-operative learning were emphasized in teachers' in-service education. Though several studies have been made in our country which tackle the same problems than our project, these have been much shorter, more specific or otherwise different. Thus it is very difficult to compare them with our study concerning general techniques or process characteristics. Several school development studies from other countries have already been mentioned.

The described action-research was good evidence for us as to how a researcher can directly influence teachers' professional development and also as to what premises should be taken into consideration. The school developmental process differed on the elementary and secondary school levels, but it certainly will continue in the community for a long time to come. Some of the elementary school teachers are participating in a continuation project on how to use multi-media systems (hypercard and video combination) in teaching. The secondary schools are continuing the development in other ways. We became convinced that an educational scientist can help the school development in many ways. Thinking of and using research results under certain conditions make scientific knowledge dynamic. And it was dynamic knowledge which we were seeking. It will be possible to replicate these experiences.

The main obstacle in the development of the senior high school was obviously the matriculation exam. The exam is traditional, rather fixed,

and dominating. The teachers whose students were used to get good results in the exam did not dare to deviate from their previous practice to a large extent. Though many teachers admitted that project-study was an effective method, they were afraid that the new method would require more lessons than the traditional teacher-centred method. The subject-matter had to be covered (and by the teacher) because of the exam. From the viewpoint of the school development, the exam was harmful. So far it has not represented dynamic knowledge.

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